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AMERICAN MACHINIST

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A Large Radial Drill Press.

We present on this and the succeeding page engravings of a drill press recently built by the Universal Radial Drill Co., of Cincinnati, Ohio, for Carnegie, Phipps & Co., which is one of the largest if not the largest and heaviest press of the kind ever built in this country, the arm being nine feet one inch radius, and the column 13 feet six inches high. The drill will operate at the center of a circle 15 feet diameter, and the greatest distance from bed-plate to end of spindle is 9 feet 5 inches. An idea of the dimensions of the machine may be had from the fact that the elbow shown on the bed has an opening 52″ diameter.

In this machine the arm does not swivel upon the column, but, instead, the column turns about upon its axis, and can be clamped to the base by heavy bolts. The method of securing the column to the bed-plate, and sustaining the weight of the column and attached parts, is shown by our detail engraving on page 2, to which we shall again refer.

The arm is raised and lowered on the column by power, there being two levers for controlling this motion — one near the bottom of the column, which can always be operated from the floor, while the other moves up and down with the arm. The saddle is moved on the arm by a geared rack and pinion movement, controlled by a hand-wheel, which is always in the same position relative to the spindle. The spindle in this machine is of steel, 4″ diameter, with a No. 5 Morse taper socket, is driven by gears powerfully proportioned, the last and greatest reduction in speed by the gears—barring the back gears—being made at the spindle itself, and is counterbalanced, with quick return.

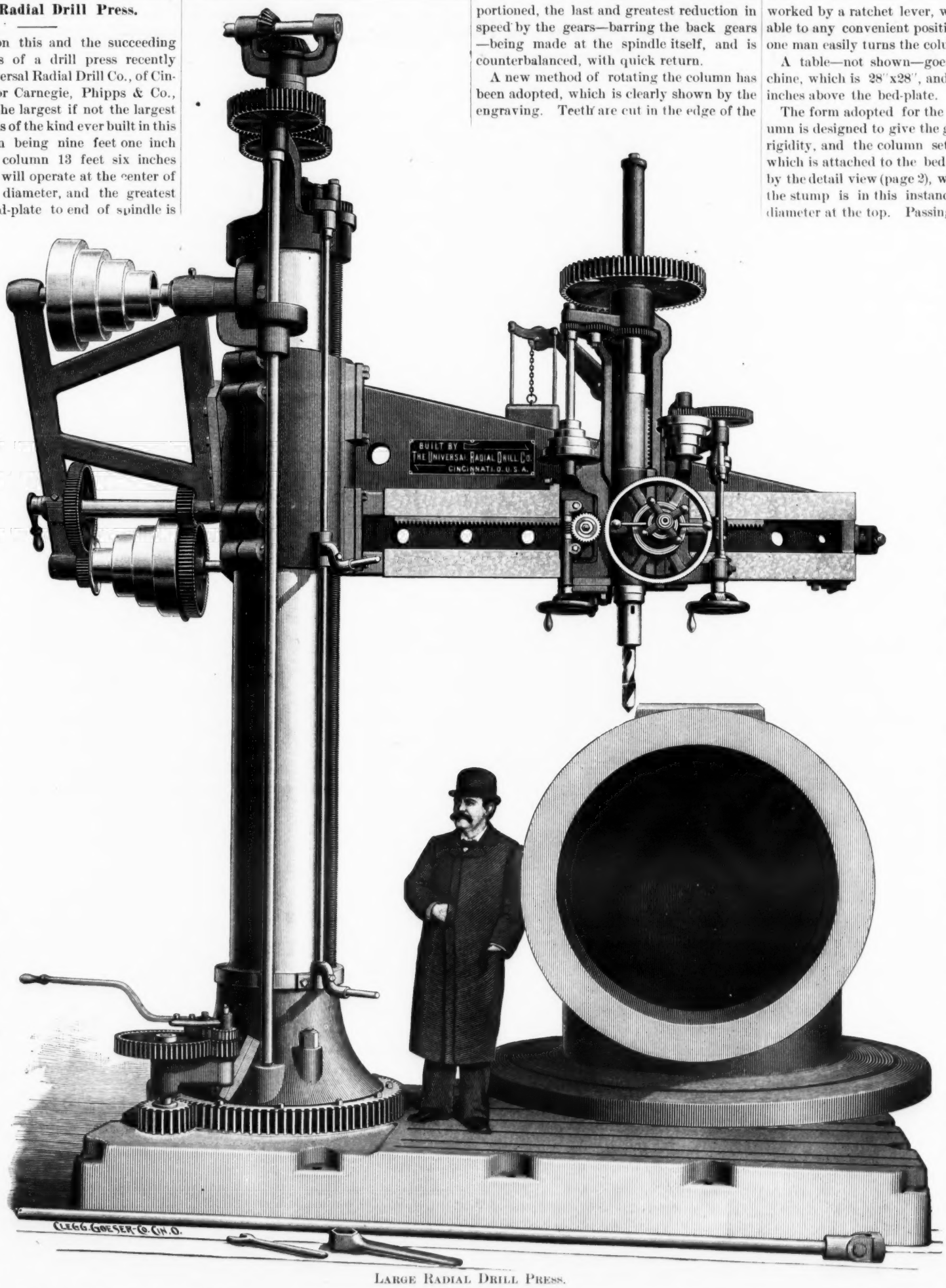
A new method of rotating the column has been adopted, which is clearly shown by the engraving. Teeth are cut in the edge of the large flange at the bottom of the column, and by intermediate gearing and a pinion worked by a ratchet lever, which is adjustable to any convenient position on the shaft, one man easily turns the column.

A table—not shown—goes with the machine, which is 28″x28″, and stands 2 feet 4 inches above the bed-plate.

The form adopted for the base of the column is designed to give the greatest possible rigidity, and the column sets over a stump which is attached to the bed-plate as shown by the detail view (page 2), which shows that the stump is in this instance 33″ high, 11″ diameter at the top. Passing down through the center of this stump is a shaft which supports at its upper end a spring diaphragm, upon which most of the weight of the column and attached parts is designed to rest, so that when the binding bolts are released the moment of friction is very much reduced, and the column turns very easily, and with comparatively little wear upon the moving parts.

The bottom of the shaft (*a*) upon which the diaphragm rests is beveled off as shown, and the shaft (*b*), similarly beveled, serves as an adjustment, this shaft being moved endwise for the adjustment by the screw shown at the other end, which is tapped into the bed-plate.

The diameter of the column is 18″; total height of machine without countershaft, 16 feet; vertical traverse of spindle, 27″. The cone pulleys are for a 4″ belt; floor space required for the base, 72″ x144″; countershaft has pulleys 24″x5″ and should run at 180 revolutions; total weight of machine, 32,000 pounds.

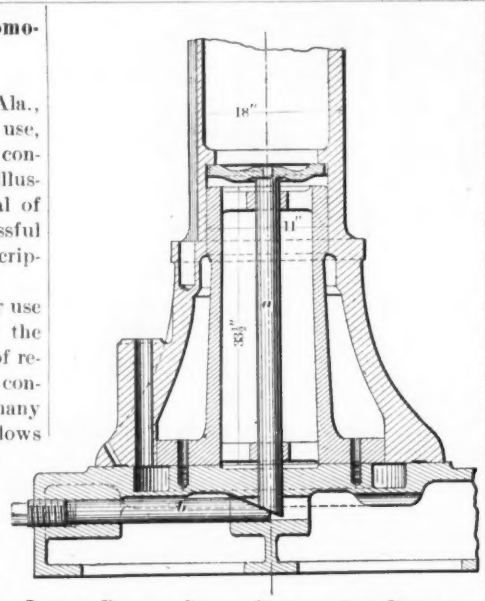


LARGE RADIAL DRILL PRESS.

Flexible Wheel Base Tramway Locomotive.

Mr. E. P. Cowles, New Decatur, Ala., has brought out a locomotive for special use, which possesses some peculiarities of construction shown in the accompanying illustration. We are informed that several of them have been built, and are in successful operation. Following is Mr. Cowles' description of this locomotive:

This engine is especially designed for use in lumbering, quarrying, etc., where the roads are built temporary by reason of requiring frequent removals, and are as a consequence very rough and uneven, with many heavy grades and sharp curves. It follows from the nature of this service that the engines are mostly used in sections remote from repair shops. It is, therefore, desirable that they should be so constructed that they can be kept in order and repaired by such mechanics and with such materials and tools as may be at hand.



Large Radial Drill Press.—See Page 1.

The object sought and attained in this engine is to produce, at a reasonably low cost, a thoroughly reliable and serviceable locomotive, having the greatest possible tractive power, by utilizing the entire weight, including fuel and water, for this purpose, combined with a degree of flexibility never before attained in a locomotive without the use of gear wheels, slip and toggle joints, so objectionable as a source of breakage, lost motion, noise and unsteady action. The entire weight is carried on two independent freely oscillating driving trucks, swiveled to the engine frame like ordinary car trucks. They are perfectly free to turn and follow curves, or twist to conform to an uneven track without in the least interfering with the transmission of the power from the engines, which are direct-acting, like any locomotive.

One axle *a*, *a*, in each truck is tubular; through it passes the engine crank-shaft *b*, *b*. They are coupled together in the center by a universal joint *c*, *c*. The truck is swiveled to the engine at this point by hangers depending therefrom. The bore of this tubular axle is larger than the shaft. On each end of the shaft, just outside of the wheels, is a double crank *d*, *d*, *d*, *d*, to which the main rods *e*, *e*, *e*, *e*, of the engines are coupled. These cranks have journals outside, with bearings *f f f f*, sliding vertically in hangers depending from the engine frame. The hangers maintain the crank-shaft always at right angles to the longitudinal axis of the engine, while they are maintained parallel to the plane of the frame by rock shafts with arms connected to the bearings *f*.

The wheels of the tubular axle have ring-like crank-pins *d d d d*, coupled to the other wheels of the trucks. The wrists of the double cranks pass through these rings. They have the same play in them that the shaft has in the tubular axles. It is obvious that while the crank-shaft is maintained in the same position with reference to the engine frame, the trucks are free to oscillate in every direction to the extent of the play of tubular axle on crank-shaft, and at the same time the rotary motion is transmitted to all the wheels as rigidly as if the main rods were coupled directly to them.

The engine frame forms a platform on which the boiler, cab, fuel-box, tank, etc., are placed. It is made with two heavy, strong sills, lying directly over the cylinders, which perform much the same office as the bed-plate of a stationary engine. Besides maintaining the engines in line, they also take all the working strain, relieving the trucks entirely of the thrust of the engines.

This permits of a strong, durable truck frame being made of a combination of wood and iron like those of a passenger coach; as far as possible iron is bolted to wood, reducing the liability of breakage to a minimum.

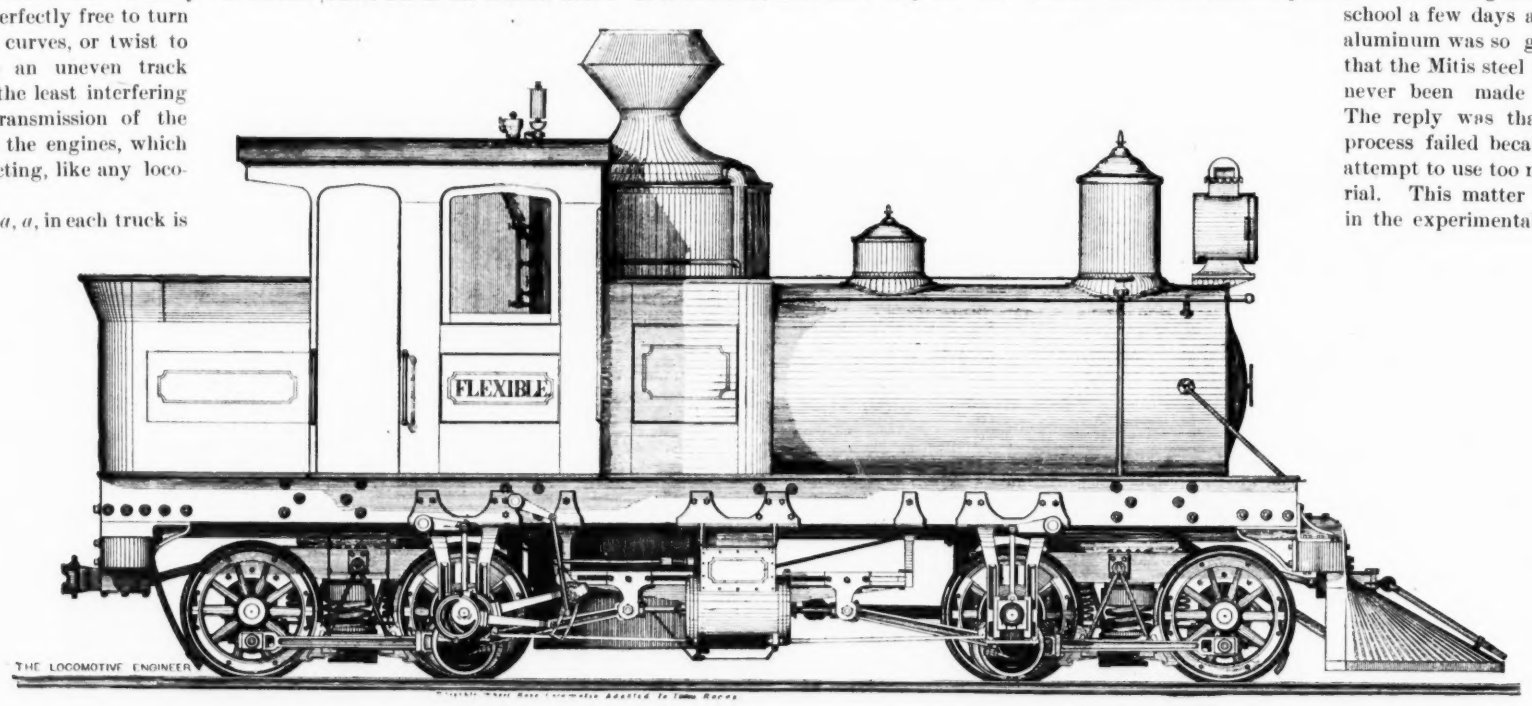
The wheels have chilled cast rims that can be removed easily. Two men can remove the worn-out tires and put on new ones in six hours, or replace them with rims of a shape suitable for wood rails.

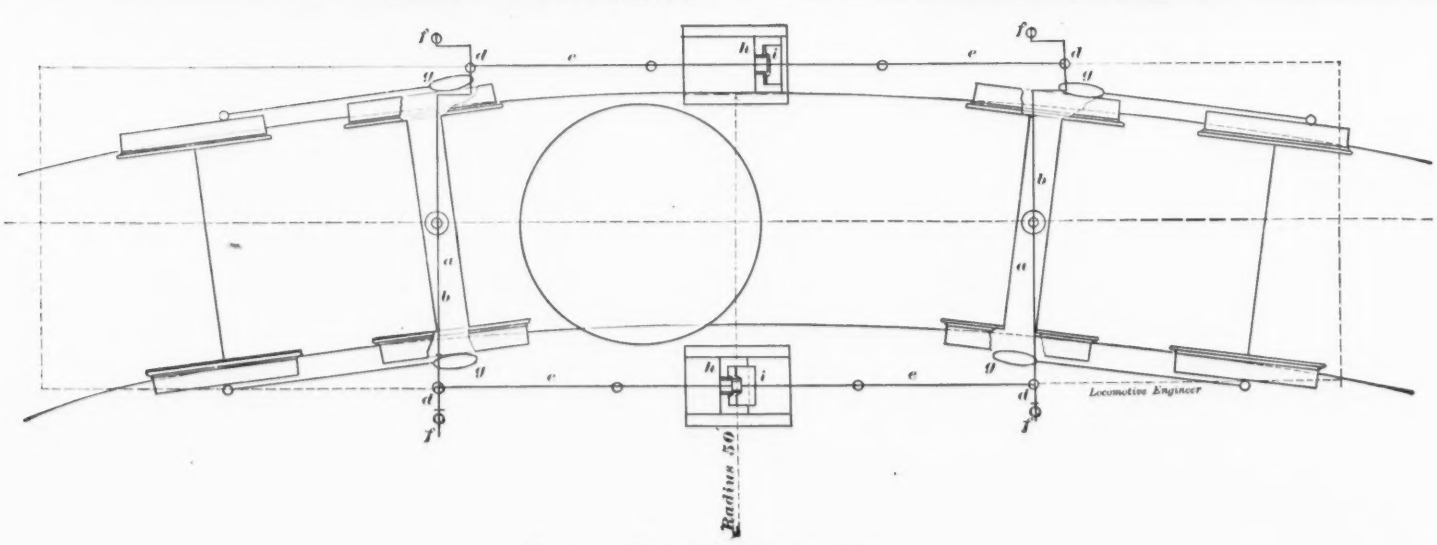
Besides the usual truck springs and equalizers there are bearing springs between the trucks and engine frame. On a very rough, uneven track, the engine runs as smoothly as a passenger coach.

The cylinders are placed midway between the trucks, with piston rods extending through each head, one connected to the rear, and one to the front truck. To compensate for the varying length of the main rods, owing to their angularity, as the cranks approach the upper and lower points in this revolution, the piston heads are made double, one *h*, *h*, annular connected to one piston rod by a perforated disk, the one *i*, *i*, connected to the other rod solid fitting steam-tight inside the first, and having a longitudinal play equal to the variation to be provided for. Their areas are equal, and obviously steam acts on each with the same force. At the same time they are free to draw out to accommodate any variation in the length of the connections. They are provided with steam cushions, which prevent concussion in case the wheels of either truck slip.

The engine illustrated weighs eight tons, which is equally distributed on eight driving wheels 26 inches in diameter; width of gauge, 42 inches, length of truck wheel base, 42 inches; total wheel base, 16 feet. It will turn curves of 50 feet radius, and twist 10 inches in the length of its wheel base; cylinders are 10 inches diameter by 12 inches stroke. The engines have balanced valves and can be reversed under full pressure of steam, slipping the wheels either way. The trucks are provided with steam brakes, which are also arranged to be worked by hand. Sand-boxes are provided at each end. The engine will run and haul equally well either way. The boiler is of the upright type, and the tank is of strong and simple form. The cab is roomy and neat, making it easy and agreeable to fire and run.

This engine has hauled four empty cars of 4,000 pounds each up a grade of 600 feet per mile, turning curves of 50 feet radius, having a grade of 450 feet per mile, at the rate of 12 miles per hour. It has run on a reasonably straight track at the rate of 25 miles per hour, and this on a 16-pound rail.





Flexible Wheel Base Locomotive.

Investigations are still proceeding to ascertain the value of aluminum as an adjunct to steel castings. Professor Arnold, of the newly-established technical school at Sheffield, is following up the important investigations of Mr. R. A. Hadfield by experiments on the properties of aluminum in the harder classes of crucible steel. In some particulars the results have been opposed to those of Mr. Hadfield. Particularly is this the case with regard to blow-holes; the tendency to "piping," due to the contraction of the ingot between the fluid and the pasty condition, seems to be greater. This tendency, it is urged, can be obviated by coring; but this practice is already common. Mr. Hadfield inquired, at the meeting of the Sheffield school a few days ago, why, if aluminum was so good, was it that the Mitis steel process has never been made a success. The reply was that the Mitis process failed because of the attempt to use too mild a material. This matter is certainly in the experimental stage yet, but Mr. Hadfield was no doubt well satisfied as to the correctness of his results before he announced them, and it may be that Professor Arnold is merely retraversing the same ground. — *The Engineer* (London).

Spain possessed the first war ship propelled by steam.

Power Pipe-cutting and Threading Machine.

The engraving on this page represents a machine recently brought out by D. Saunders' Sons, of Yonkers, N. Y., and intended for threading pipe from ⅛ inch up to 2 inches.

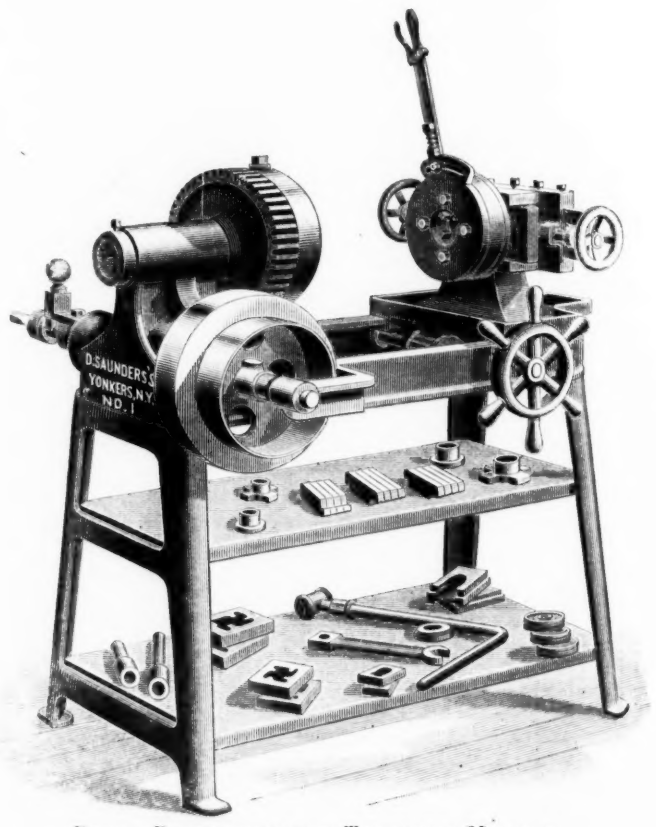
The chuck which holds the pipe is attached to the face of the large gear wheel seen, and is universal. The shaft on which the cone pulley is mounted drives by means of bevel gears a shaft which is under and parallel to the main shaft, and there is a double set of these gears fitted with a double-ended clutch, by which two speeds are obtained with each step of the cone pulley, or four speeds in all.

The carriage is moved on the bed by rack and pinion worked by hand and, mounted upon the carriage, may be either the expanding die shown in the cut or a solid die, as preferred.

The expanding die is adjustable for size, is opened or closed by the simple movement of a lever, and has interchangeable chasers, which are quickly changed from one to the other. The opening and closing of these dies is accomplished by cams formed in a ring, which passes round the circumference of the die holder, this ring being in the larger sizes turned by a worm, and in the small by a lever, as shown in the cut. The slotted arc shown on top of the die holder is simply to afford an adjustment for the stop, by which the adjustment of the die to the required size is made after it has been opened to release a pipe that has been cut. In setting to size, one of the flanged collars shown on the upper shelf below the machine is placed in the head, and the lever moved to bring the chasers in contact with it. The stop is then adjusted so that, when the spring plunger bolt engages with it, the die is brought to the same size.

The cutting-off slide does not interfere in any way with the die, and when pipe is to be cut off, it is simply passed through the opened die, and the cut-off slide used independently.

If desired, a bolt-threading and nut-tapping attachment can be furnished with the machine.



POWER PIPE-CUTTING AND THREADING MACHINE.

Value of Pressure Records in Connection with Water-works.

BY CHAS. A. HAGUE.

(A Paper Read Before the Eleventh Annual Convention of the American Water-works Association at Philadelphia.).

A consideration of modern tendencies in the development of this great republic leads inevitably to the conclusion that its progress is along the lines of scientific advancement. Perhaps in no particular is this more true than in its application to the attention given to sanitary and fire protection problems—for what is more important than the protection of life and property? Therefore, of late years, water-works systems have increased in a rapid ratio. That this growth has been a healthy one, is evidenced by the attention given to the subject of their betterment, no other proof of which is needed than that furnished in the popularity of our annual gatherings for the interchange of thought and mutual tender of data, most of which becomes of lasting value in our published proceedings. In considering the many relations existing between the water boards or companies and their patrons, and the municipality under which they exist, and not forgetting that important creature, the fire underwriter (whose fire loss is not his, but our loss), I have become forcibly impressed with the gravity of an oversight quite common even among the most conservative of our water-works systems, and which is suggested by the title to this paper I have the honor to present for your judgment. The writer has observed for a number of years, the construction, operation and extension of water-works plants for public supply, and has arrived at the conclusion that the great importance of a continuous complete knowledge of the pressure being maintained throughout every part of a water-works system is in the interest of water companies, cities, taxpayers and fire underwriters, in the interest of health, in the interest of safety, and in no manner can such information be obtained other than by automatically and continuously written pressure records, produced at various points of observation at the same time. Broadly stated, it would seem to be true that, as water-works systems imply quantity and pressure, complete data regarding them is required. The quantity factor is determined nearly enough by the revolution counter attached to the engine in a large majority of cases, but the other feature is not, although the two are interdependent for maximum efficiency. In laying out or in extending a system of pipes, care is taken, of course, to so proportion and arrange them as to give the most efficient distribution for domestic, manufacturing and fire service; and as each case is peculiar to itself, according to the area of section to be covered, general levels and special conditions, the success depends upon many calculations, which, in the nature of the undertakings, are more or less theoretical, and not to be exactly determined until the works are in operation. Bearing upon this particular point, Mr. Edwin Darling, Superintendent of the Pawtucket (R. I.) Water-works, says in his report for 1889 as follows: "No well-conducted water-works can afford to be without recording gauges, and when properly located they will, in my opinion, pay for themselves within one year. We challenge any water-works in the United States to play seventy one-inch fire streams through fifty feet of hose, and maintain eighty pounds pressure during the trial, the pressure to be verified by recording gauges placed at suitable positions on the line of pipe."

Further, even when the construction and distribution are practically correct to meet the conditions originally imposed, the rapid and ceaseless growth of American cities presents a never-ending necessity for change and readjustment. One portion of a city or village will, although unforeseen, be found to be possessed of desirable features as a manufacturing center, increasing the demand for water, both for domestic and fire service entirely beyond any extent looked for when the plant was devised. Such a state of things, in the absence of records, will be most certain to bring us very readily and suddenly, at some time or other, in contact with the disagreeable and dangerous fact that the distributing system is entirely inadequate to meet the demands for water; but if we are provided with means for observing, from day to day, continuous and recorded evidence, to which we can turn back and refer, ample time will be found to become possessed of a complete knowledge of the requirements, and the most effective manner of meeting all demands will be indicated.

In another section of a city, perhaps limited to comparatively a few squares, the commercial and similar interests may become concentrated in lofty office buildings, while another portion, quite remote, may be devoted to a thickly settled population, all such occurrences modifying the efficiency or reliability of a water plant laid out with the idea of uniform distribution of water. We may not want uniform distribution, but on the contrary, a very uneven disposal of the supply; we can, to be sure, when we meet unexpected difficulties and dangers, make some attempt in the dark towards a remedy, but how much better to have a graphic indication of the giant's pulse always before the eye, so that undue congestion, or an approach to heart failure, may be known and met long before any serious results are possible.

One twelve-story building in our larger cities may need an amount of water usually allotted to the population of a square mile, and those in charge of such buildings have long since found it necessary to so place their pumps as to enable them to draw all that the mains in their immediate vicinity can supply, regardless of the adjacent neighbor, who might get to wondering where the water had gone or was going to.

If a certain number of gallons of water per capita is essential to the health and comfort of a community, such can only be effective when properly distributed, and we can know when it is properly distributed only when we know that sufficient pressure is available at the various points to deliver the required quantity of water. First ascertain what is going on within the system, and the point at which any remedy is needed, and the manner of applying it will be suggested at once.

Of course, you all realize the seriousness and importance of the fire service, and many of you no doubt can recall incidents and accidents, wherein nobody exactly knew what did happen or how it happened. You only were aware that at some vital moment or other the water pressure failed. How far from the hydrant the failure extended you could not tell. The pumping station people declared that the pressure was all right where they were, but even they had no evidence, only their unsupported assertions. You have been making changes and extensions, and dwell in fancied security, when suddenly the call of danger comes, and you find to your sorrow that some conditions existed of which you were not aware, which costs somebody many thousands of dollars, and after which you quietly apply such remedies as in your darkened state of information you conceive will meet the case.

In the larger cities where fire engines draw their supply from hydrants, many disputes have arisen as to whether there was or was not sufficient pressure to supply the steamer.

It is possible to run a steam fire engine too fast to get any water to speak of, whereupon the charge is made at once that the mains were not under proper pressure at a certain time. A pressure-recording gauge would establish the fact if the pressure existed in the main or not, and thereby teach the firemen that they must look out for their end of the combination or take the consequences. It is sometimes the fact that more steamers are drawing from the water mains in any certain locality than the capacity of such mains would justify, the result being that a less number of engines would do more real execution on the fire, for the simple reason that the same quantity of water would be delivered by fewer engines under a higher pressure than could be maintained by the greater number drawing simultaneously. This fact can only be arrived at by having records continuously made at different points throughout a system, it being evident that if a continuous record of pressure was kept, at some time or other it would be made plain that the pressure was inadequate, calling attention to the fact in time to enable the application of a remedy long before the discrepancy had reached a dangerous point. This condition of overdraught of water in a given section is exactly what occurred in the recent Furman street fire in Brooklyn, and which resulted in a very much greater loss of property than would have occurred had the steamers been able to get all the water they required and could handle. What has since been done, viz., the placing of an additional feeder to this section, might before have been done, and would have been, had records been regularly made whenever a fire occurred in that vicinity, showing how easy it was to draw the head down below a safe and prudent point.

Upon one occasion coming to the writer's knowledge, where a part of the water supply was pumped by water power and in case of fire the extra quantity was delivered by starting additional turbines, the fire department was somewhat tardy, and the fire obtained such headway that a great amount of damage was done that should have been averted. An investigation of the facts proved by the chart from the recording gauge that the water was increased in pressure immediately upon the fire alarm signal, notwithstanding that the fire companies all testified they were on hand within a few minutes, and there was no pressure. The superintendent of the water-works would have lost his position had he not been able to produce his record, and the multitude of witnesses who declared there was no pressure would have overcome the facts, the truth and the engineer's statement.

In a certain city, politics interfered, as it sometimes will, with the efficiency of the water department, and it was determined to oust the superintendent because he had been too active to suit the "outs." By prearrangement they filled the hose pipes with stones, and the flow of water was so restricted that some of the citizens became alarmed in watching the headway the fire was making, and went to the pumping station, only to find by the recording gauge that the pressure had been properly maintained without a moment's loss. This fact established, the "boys" took opportunity to clear out the hose pipes one by one without being caught at it. Detectives subsequently arrived at the facts as above stated.

In another place, a washout occurred during a rainy night, and opened one of the joints on the force main, where its embankment was exposed near a ravine. The pressure was reduced so much and so suddenly,

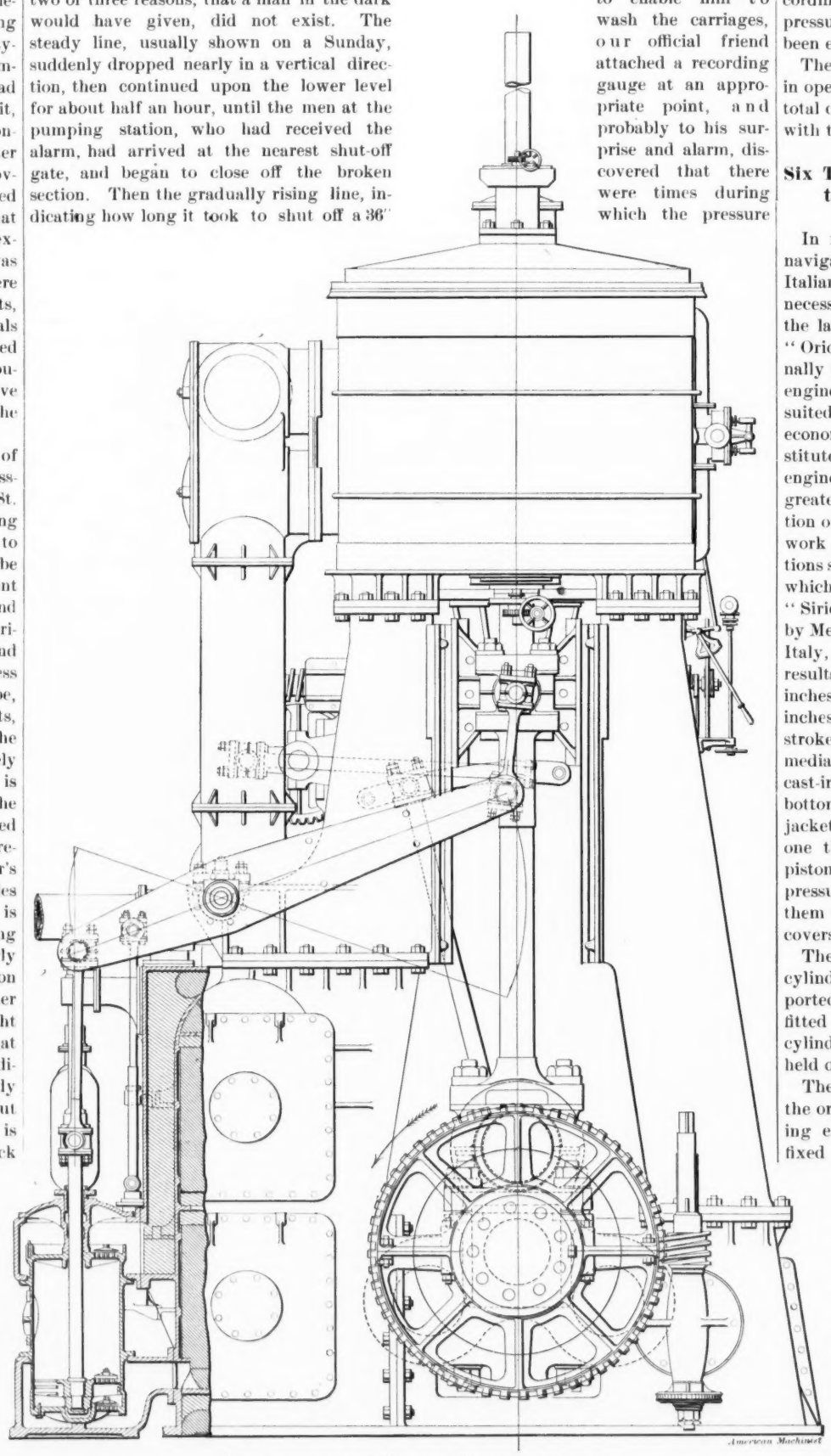
that the low-pressure electric alarm sounded, calling attention to the great loss of pressure, and to the discovery of an enormous leak somewhere on the line. The superintendent was enabled to locate and remedy the accident before extensive damage had been done by the escaping water, to say nothing of the danger of fire and lack of water during the very much longer time that would probably have elapsed under other conditions.

Another example is of a gravity supply, which, becoming inefficient, was supplemented by boring wells, and supplying pumping machinery costing some twenty-five thousand dollars. Some time after completion, one of the large manufacturers had occasion to overhaul a turbine wheel pit, and, in so doing, encountered what was considered a large and copious spring. After exploration and examination, it was discovered that that spring could only be stopped when the 10″ main delivering water to that section was shut off, and when this unexpected and previously unknown leak was repaired, the new wells and machinery were not needed. Carefully noted record charts, in this case, consulted at regular intervals during the period of complaints, which led to the investment of the twenty odd thousand dollars, would most undoubtedly have developed facts that would have saved the unnecessary addition.

One of the most remarkable examples of the utility, value and practicability of pressure records is exhibited in the city of St. Louis, where by their use the distributing system is shown to have been brought up to a perfection which leaves very little to be desired. The losses of head in different directions from the pumping station and reservoirs, considering the amount of territory covered, are surprisingly small and uniform, indicating with perfect clearness that whatever the varying demands may be, whether in the manufacturing districts, where the demand is very large, or in the residence portions, where a comparatively thinly occupied area draws only what is needed for domestic use, the capacity of the distributing mains is properly proportioned to the work to be done. There is one recording gauge in the water commissioner's office, in the City Hall, about three miles from the pumping station, and so perfect is the circulation, that the starting or stopping of any of the pumping engines is clearly marked. The day's history shown upon the chart is about as follows: Soon after five in the morning, the gradual but slight fall of pressure from a horizontal line that has been maintained for several hours indicates that the early risers are getting ready for breakfast; this fall goes on until about six, when an additional pumping engine is started to work, bringing the pressure back to nominal or a little above. About six-thirty to seven, when the manufacturing concerns open up, the demands are clearly shown. Then the sprinklers taking water near enough to the City Hall to be felt, begin to draw water, and so the line goes on throughout the day, clearly giving the history of that day's consumption. Soon after six in the evening, the gradual rise of pressure attests the fact that the day's work is over, that too much water is being pumped, and after this is allowed to go on so as to bring up the reservoir to a normal point, at ten or ten-thirty, the slight drop in the line plainly gives notice that one of the engines has been shut down; then the pressure line runs along through the night hours nearly or quite uniformly. The stoppage of an engine in the night, either from intent, accident or carelessness, is plainly marked; also the time which elapsed before that or another engine was started again. Water Commissioner Holman has a habit of looking over the chart each day, and before the people at the pumping station understood how on earth the commissioner came to be so well posted, he occasionally astonished them by quietly dropping in and asking "the cause of the stoppage of a certain engine the night before."

A very interesting example of the value of record pressures was exhibited at St. Louis last fall, when one of the 36″ mains burst about half a mile from the pumping station, and two and a half miles from the City Hall recording gauge. It occurred about two-thirty Sunday afternoon, and no one would have known, without a continuous record, that there was no water hammer indicated just before the break, and its cause would have been enveloped in mystery a good deal deeper than it was, if the gauge had not shown with perfect accuracy that two or three reasons, that a man in the dark would have given, did not exist. The steady line, usually shown on a Sunday, suddenly dropped nearly in a vertical direction, then continued upon the lower level for about half an hour, until the men at the pumping station, who had received the alarm, had arrived at the nearest shut-off gate, and began to close off the broken section. Then the gradually rising line, indicating how long it took to shut off a 36″ gate, was drawn by the faithful monitor, until normal conditions and pressure was recovered. That record places beyond all dispute any and all claims as to time and duration of that break, with reference to damage suits, quantity of water possible to have been discharged, and other important items. Not the least part of the value of pressure records in this particular case, although an incidental one, was the high order of discipline and attention prevailing among the engineers in consequence of such a system at the pumping station, and which, no doubt, saved the city many thousands of dollars by reason of the prompt control of the large pumping engine suddenly relieved from pressure.

In a western city, a neighbor of one of the water company's officers suffered a fire loss at his residence, and meeting said officer, complained that if there had been a little more water pressure, the conflagration could have been extinguished at its earliest stage with a garden hose. The officer expostulated at the idea of the pressure not being sufficient to supply a garden hose, but when, a little later on his own coachman complained, for the second time, that the water would not run in sufficient quantities to enable him to wash the carriages, our official friend attached a recording gauge at an appropriate point, and probably to his surprise and alarm, discovered that there were times during which the pressure fell to a point too low for the proper delivery of water at the points complained of.



Engines for the Italian Steamship Sirio.

Thus many instances could be introduced to exemplify the usefulness of such records, and in fact the gauge record is really the indicator card of the water-works system, and no actual knowledge of any value to speak of can be obtained in either case, without the appropriate instruments. Just imagine, if you can, where the refinements of steam engineering would have been today without the assistance of the indicator, then apply the reasoning to the other case, and draw your own conclusions.

It may be of interest to you to know that the recording gauge has been applied to the great oil pipe lines from the oil fields to the seaboard, where it is necessary to use heavy pressures, reaching as high as 1,100 pounds per square inch at the pumping stations. Bursts in the lines, with the attendant fires, are of frequent occurrence, but by the use and benefit of the pressure record pointing out, as it did, abnormal conditions, sudden rises in pressure, caused by trouble with the pipes, and which would burst a pipe before any one noticed the rise for a few seconds only in the already heavy pressure, were prevented. Since the introduction of the recording gauge, the troubles of abnormal pressures and breaks in the pipe lines have been entirely prevented.

There are now over a hundred gauges in operation on the oil pipe lines, and their total cost sinks into insignificance compared with the losses they have prevented.

Six Thousand Horse-power Engines for the Italian Steamship "Sirio."

In recent years the conditions of ocean navigation have been so changed that the Italian Navigation Company found it to be necessary to increase the speed of three of the largest ships of their fleet, the "Sirio," "Orione" and "Perseo," which were originally fitted with compound engines. These engines were not old, but they were not suited to the high pressure necessary to economy. It was therefore decided to substitute, for the old engines, triple expansion engines and new boilers, so as to obtain a greater power with relatively less consumption of fuel. It was also decided that the work should be done in Italy. Our illustrations show the new triple expansion engines, which have been placed in the steamer "Sirio." These engines were constructed by Messrs. G. Ansaldo & Co., Sampierdarena, Italy, and have been at work with excellent results. The high-pressure cylinder is 37 inches diameter; intermediate cylinder, 61 inches; and low-pressure cylinder 98½ inches; stroke, 5 feet. The high-pressure and intermediate cylinders have separate linings of cast-iron and steam jackets. The covers and bottoms of all three cylinders are steam jacketed. The pistons are of cast-steel of one thickness only, dished in form. The piston rods of the intermediate and low-pressure cylinders are continued through them with guide rods through the cylinder covers.

The slide valves of the M. P. and L. P. cylinders are of the common type, double-ported; and single-ported piston valves are fitted for admitting the steam to the H. P. cylinder; the spring rings are of cast-iron held out by well-tempered flat springs.

The valves are actuated by eccentrics, and the ordinary link motion; the reversing being effected by a double cylinder engine fixed on one of the front columns, and all round reversing gear.

The piston rods, crossheads, connecting rods, and all parts of the working gear are of wrought-iron. The piston rods through cylinder bottoms are $9\frac{7}{16}$ inches diameter; through cylinder covers they are $6\frac{7}{8}$ inches diameter. Connecting rods are 11 feet $1\frac{7}{8}$ inches long; diameter at crosshead end, $8\frac{5}{8}$ inches; diameter at crank-pin end, $10\frac{5}{8}$ inches. The crank-shaft is made in three interchangeable portions, and is built up, having the shaft itself, the crank-pin, and the crank-arms of separate pieces. The crank-pin is $20\frac{1}{2}$ inches diameter; length, $23\frac{5}{8}$ inches. The crank-shaft bearings are $18\frac{5}{8}$ inches diameter; their aggregate length is $141\frac{3}{4}$ inches. The surface condensers are placed at the back of the engines, and form part of the supports of the cylinders; the exhaust steam is led into them from the L. P. cylinder by two cast-iron pipes. The condensers contain 4,222 brass tubes $\frac{3}{4}$ inch external diameter, with a cooling surface of 9,200 square feet. The cold water is circulated through them by two of Messrs. J. & H. Gwynne's centrifugal pumps, having outlets of 13 inches diameter; these pumps are so arranged that they may be used for pumping water out of the ship in case of accidents. At the back of each condenser there is an

air-pump, a feed-pump, and a bilge-pump worked by means of beams and slings from the piston rod crosshead. Diameter of each air-pump (two in number) is 25¼ inches; stroke, 2 feet 6 inches

White meta has been fitted wherever there is much friction; it is fitted to the main brasses, the crank-pin brasses, the slipper plates, the thrust bearing, etc.

The propeller is 18 feet in diameter, and is fitted with four adjustable blades of cast-iron; the hub is also of cast-iron.

Steam for engines is provided by four double-ended boilers 14 feet in diameter, and 17 feet 8½ inches long, constructed for a working pressure of 160 pounds per square inch. Each boiler has six furnaces fitted with Purwis patent ribbed flues, which have been found to answer admirably. The total heating surface in all the boilers is 13,993 square feet, and the grate surface is 500.5 square feet. The boilers are made entirely of Siemens-Martin steel, the plates of the combustion chambers being of a special fire-resisting quality. The best workmanship is claimed to have been employed throughout their construction. The rivet holes were drilled in place after the plates had been bent and fitted together. The riveting was done with hydraulic riveters of 100 tons. There is a funnel for each set of two boilers, 7 feet 3 inches in diameter, and 71 feet 3½ inches high from the deck plate.

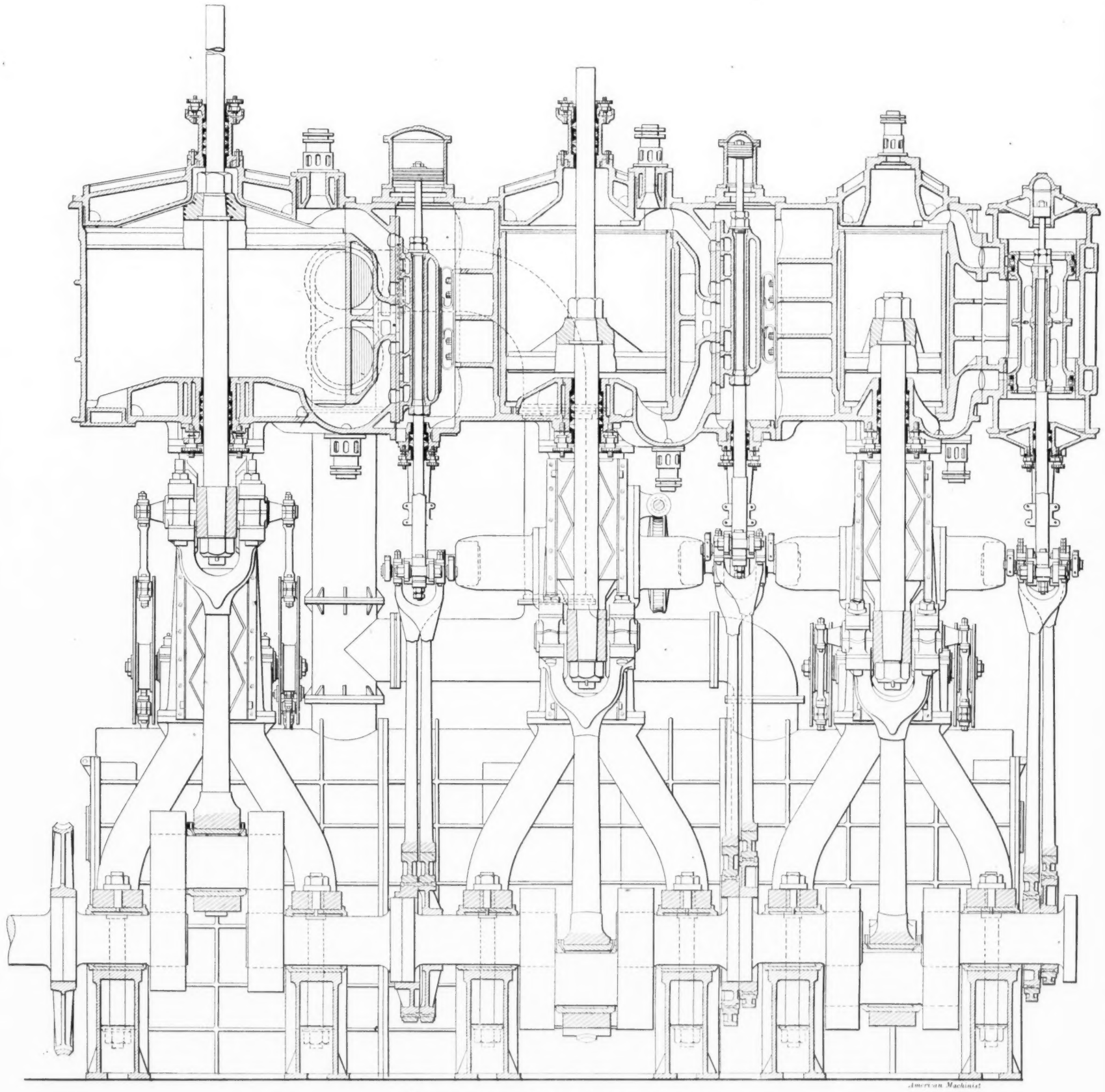
The "Sirio" was the first of the three vessels taken in hand, and when the old engines and boilers had been removed, it was found that considerable modifications and additions would be necessary to adapt the engine and boiler-rooms for the new machinery. The vessel was ready for steaming at the moorings on the 17th of November, 1890, and two days after left for Leghorn to go into dry dock to have her bottom cleaned. On her return she was brought down to a mean draught of 20 feet, and after a preliminary run on the 3d of December, the official trial took place on the 6th of December, with very satisfactory results; the engines worked well, indicating a maximum horse-power of 6,148 or 1,148 over the contract. The engines were run at 75 revolutions per minute, and the speed of the vessel was 16.6 knots. The mean pressures in the cylinder were: H. P., 69 pounds; M. P., 31.425 pounds; and L. P., 13.335 pounds. A final trial was made on the 15th December, the results being equally satisfactory.

The second of the three vessels, the "Orione," has now been taken in hand, and the work of setting up the new machinery will shortly be commenced. The engines for the "Perseo" are in an advanced state of completion.

It is stated that at the works of G. Ansaldo & Co. several sets of the above machinery can be built in the course of a year. It is claimed that they have all the facilities for doing that class of work, and there is no longer any necessity for the Italian Royal or Mercantile Marine to go to other lands for their large steamers. G. Ansaldo & Co. can furnish the hulls as well as the engines. They have now at their yards, in course of construction, three steel steamers of 4,000 tons each, which are larger than any merchant service steamers built in Italy. One of these is nearly ready for launching, and it will be quickly followed by the other two. The engines for these vessels, like those of the "Sirio" and her sister ships, were designed and built at Sampierdarena, where the machinery of 20,000 H. P. for the armor-clad "Sicilia," consisting of four sets of engines, and 20 boilers, was also recently constructed. This firm also has under way, at their works, the machinery of 4,000 H. P. for the torpedo catcher "Minerva"; the machinery of 6,500 H. P. for the unarmored cruiser "Liguria"; and four sets of 1,000 H. P. for sea-going torpedo boats; the hulls of all of these ships are now being built at the firm's yard in Sestri-Ponente. They are also building the machinery of 10,000 H. P. for the cruiser "Marco Polo" whose hull is now being built at the Royal Italian Dockyard at Castellamare.

Messrs. G. Ansaldo & Co. erected the necessary plant for this class of work in four years, and now employ over 2,000 persons.

It is said that the very heavy import duties imposed on metals interferes with the successful competition of this company with firms in other parts of the world; but, owing to the great difference between the cost of labor in Italy and other countries, and the help of the government bounty, they are able to compete successfully for Italian work, and of this they have given ample evidence.



Engines for the Italian Steamship Sirio.

The fourteen Southern States, together with New Mexico and Arizona, have established a permanent exhibition of their products and resources at Raleigh, N. C. The permanent exhibition opens May 15, and from October 1st to December 1st a southern exposition will be held. Northern manufacturers are invited to exhibit machinery and labor-saving devices.

LETTERS FROM PRACTICAL MEN.

About Mechanics.

Editor American Machinist:

The articles on the subject of the "Born Mechanic," by several writers in your paper of late, bring to my mind some thoughts on the subject that slightly differ from those already expressed. I am fully persuaded that mechanics, like poets, are born, not made; but when they are born, and for years afterward, they are no more finished mechanics than a heap of castings are finished machines; they are only the proper material to make mechanics of; the finished mechanic comes from the work done in developing the inherent qualities in the material, and, like a lot of pieces subjected to the same processes in the shop, as nearly as human skill will allow, it is usually not difficult to find some that are not quite as near the standard as others, and this may come from defective material or from any of the many disturbing influences arising in finishing; so it is with persons—the stock we have to make mechanics of, they vary much more than castings—and my experience with the latter has given me trouble enough.

As among the many who write verses there is only now and then to be found a poet, so among the many who follow the mechanic arts there is only now and then a true mechanic.

I may have my idea of what constitutes a true mechanic narrowed down rather more than some of your correspondents, or, in fact, than the common dictionary definition of mechanic, but Mr. W. S. Rogers' foreman, "Tom," I should place in that class.

The man who is able from his own brain, unaided, to devise ways and means to accomplish desired results has the gift that has to be born in a man.

Many persons like to think themselves possessed of this gift, and pose before the world as wonderful mechanics, when the truth is they have a keen observation, a good memory, a good address, and a desire to travel to see and be seen. These things combined, if turned in almost any direction, will produce a good copyist, and may make some money, but to my mind the admission that a person has been very successful in making money in an ordinary manufacturing business, unprotected by patents, is almost a proof that that person has other qualities predominating the true mechanical one.

It is almost an established fact that the highest mechanical talent, and the ability to drive sharp bargains, are never combined in one person.

I once worked for a man who thought himself a real mechanic and inventor, he was well educated, had traveled much, made money, and was well respected in the community; but if I may express my opinion of him, I should say his mechanical ability was a minus quantity, for he made some very serious blunders in the mechanical line, because he was so stubbornly set in his opinion that he really would not see when the fact was self-evident. I think if this person could be shut up alone, and where he would be undisturbed for a week, that he would develop nothing, for it was his power of copying and combining that made him a mechanic before the world.

Again, I worked once with a man who was called a good mechanic; he would do a job just right, if he happened to get started right, and would do it the same way every time, could tell how he used to do any job, but was totally at a loss to devise any new way. I cannot say whether he was born in a house or the shop, but one thing is certain, he was not a "born mechanic," for 30 years of development has made him nothing more than a good workman.

The best foreman I ever worked under was a true mechanic, although not a fine workman; his name may be found occasionally in the *Official Gazette* of the U. S. Patent Office, and always to something new, not merely to old ideas worked over. I hope he may soon receive something of more value than favorable mention for his labors.

In the February 27th issue of *The Engineer*, of London, near the bottom of the first column on the first page, mention is made of the "persistence of mechanical and business ability in the Denny family." (I may add the Dennys are a famous firm of Scotch shipbuilders at Dumbarton.) So it seems our English cousins believe in the fact.

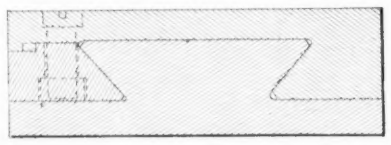
One more illustration: I once knew a man who was a good citizen, and who could do a very good job of plain planer work; his father used to run a machine shop, and in it there were two shafts parallel with each other, and another at right angles, which was the first shaft placed in position. In discussing the best means to drive the two parallel shafts, my subject said, "Father, why not bend an elbow in the shaft to go around the corner," and said it in good faith too; his father only said, John! John! and the laugh was only repressed out of respect for the father. Surely this man was not a born mechanic. And I am not afraid to shoulder my position, but am open to be convinced by good, sound argument and statements of facts, if I am wrong.

CHARLES S. BEACH.

Lathe Slides.

Editor American Machinist:

The letter from "Anglo-American," in your April 9th issue, revives a subject that was argued some years ago in some of the mechanical papers—perhaps in the AMERICAN MACHINIST itself—so that an extended discussion on the subject would be to many an old story. Without a recapitulation of the argument, I simply present the sketch enclosed with these questions: Ought not



the gib to be on the side shown? as in boring the lifting strain is on the right hand side. Is not the 45° angle better than the 60°? Are not the round fillets in the angles, and the chamfered corners, better all around? I saw a lathe made this way somewhere—perhaps Bullard's. I am quite sure it was one of his that had the slide on top about as long as the lower part; and is this not right, making the wear nearer even and better protecting the wearing surfaces? The short block seems to wear the lower part most in the middle, and when the gib is taken up it is too tight at the ends.

In the sketch the scheme for taking up wear is to move the gib endwise, slots in the gib for screw and nut permitting this to be done. A part of the spring must be due to the spring in the metal itself, a part to the necessary looseness to give free play, and a part to the oil squashing out from between the surfaces. The first and last of these two causes are improved by the long fit.

The statement of fact made by Jarno, that the lathe spindle would settle in the oil so as to run eccentric, shows that there is a measurable degree of give to the film of oil, and his explanation of the reason why a planer changes the cut by standing is no doubt correct in part at least. In the case where it becomes necessary to stop a planer, even for a short time, it should be stopped at the completion of the cut, and not at the commencement of the next one. This gives the oil a rub up before the cut begins, and avoids the mark in the work, as any planer hand can prove by trial.

GILES GRAHAM.

Ten or Twenty Horse-power Engine.

Editor American Machinist:

Your correspondent G. G. wants to know whether he shall use a ten horse-power engine five years and then sell and buy a twenty horse-power, or buy a twenty horse-power in the start and pay for coal. I see that he has been advised both ways, but for my part I cannot see how both can be right, all else being the same. G. G. says the ten horse-power engine will cost $1,000 (I suppose he means boiler and engine), while the twenty horse-power engine will cost $1,700, a difference of $700, which amount put into the business should return 25 per cent. (at least) = $175 per year × 5 = $875 for 5 years. He then sells the outfit for $300 + $875 = $1,175, the $700 being invested in the business as yet. He can then draw out $525 from the $700 invested, and still be ahead $175, besides the difference in the saving of coal, etc.

If G. G. should not wish to go to the expense and bother of changing from a ten horse-power to twenty horse-power, let him buy a twenty horse-power engine, and (instead of taking off one head and only using one end) put in a bushing, reducing the cylinder to a size sufficient for a ten horse-power. Then when he wishes to make any change, pull out the bushing and put in a larger piston.

About the boiler, if I had the plant to pay for, I would put in a full capacity twenty horse-power boiler, as I am convinced that you get more benefit of the coal when you have to use only a slight draught.

Years ago I had occasion to note the difference between two coal stoves, conditions (except in size) being the same. The small one had to be crowded to its utmost, and the result was a good deal of heat went up the chimney. The large stove, bought to take the place of the small one, held a larger quantity of coal in the fire-pot, and did not have to be forced at all; result, radiation of heat where it was wanted, and coal burned clean; more heat at less cost.

If G. G. has a boiler of good size, and chimney sufficiently large to allow of free escape of products of combustion, some at least of the hot gases will have time to part with their heat. I would also recommend having a good careful fireman, unless the coal merchant pays a premium for using his coal.

G. SCHNEIDER.

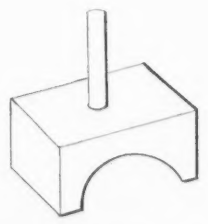
That Schiele Bearing.

Editor American Machinist:

It may seem to some a little singular that Mr. Harrison should manifest so much interest in the welfare of my Schiele curve bearing, after he has, at various times, said so much to decry it. But after reading his article in your issue of April 16th, in which he kicks back at Mr. Richards, and objecting to the word "opinion," makes this broad statement, "I always give facts," he may be interested to learn that the bearing, which has brought out so much discussion, has not caused its owners any trouble, but has run right along every working day (and occasionally a night) for more than three months. Cost of maintenance for repairs, nothing, and for oil, little. These are *facts*, not *opinions*.

During part of the summer, and all of the fall, the grain elevator will probably run nights as well as days, so that the bearing is likely to be pretty thoroughly tested, and in case Mr. Harrison thinks it has not yet had a test, he can ask at some future time for another report.

ARTHUR M. LANE.



Keeping Commutators Smooth and Round.

Editor American Machinist:

I wish to describe the method used in the grain elevator of which I have charge to smooth the commutator of the 150-light incandescent dynamo. It is simply a block of maple, with a handle like a square chisel mallet, with a semi-circle cut in outer end of block (see sketch), the circle to fit the commutator. Lay a piece of fine emery cloth in the semi-circle, fasten it with a tack on the side of the block, and grind away, running the dynamo about half speed. With this arrangement, and a little judgment, commutators can be kept smooth and round at little expense.

A. A. CROSS.

Modern Development of the Steam Engine.

BY HARRIS TABOR.

THIRD PAPER.

The Buckeye engine may be classed as a distinctive type, differing somewhat from the other high-speed machines, and radically from the Corliss. As said before, it belongs to the shaft governor type, and, in this respect, bears resemblance to the well-known single-valve automatic. Its radical departure from all other types is in its valves and valve connections. As the makers suggest in their catalogue, the main valve is really a moving steam chest, with ports through the inner face leading to the cylinder, for admission, and overlapping the cylinder ports. The ends of this sliding chest perform the functions of exhaust valve by uncovering the cylinder ports on its extreme travel. This method of steam distribution passes the exhaust steam around the main valve, on its way to the atmosphere. The cut-off valves are two plain riding plates, passing over the ports in the main valve, and are operated by a rotating eccentric under control of the governor on the shaft. The valve connections leading to the cut-off valves are one of the peculiar features of this engine, and are models of ingenuity and efficiency. As in the usual case, the main valve is driven through a rocker. This rocker is bored, midway in its length, to receive the cut-off rocker, which is journaled in the center. The rod leading from the governing eccentric to the valve connection is jointed to the lower end of the rocker, and the valve rod is connected to the upper end, passing thence through the main hollow valve rod to the cut-off valves in the moving steam chest. A moment's thought will show this to be a peculiar motion, one that gives equal results with a cut-off eccentric travel reduced one-half. It is a motion that cannot fail to attract the attention of the observer.

The feature in the Buckeye that has elicited most criticism from its competitors is the exhaust jacket around the steam chest. In theory this argument seems to have some foundation, but the fact that its builders remain in the race against their strongest competitors is evidence that they, and a large number of buyers, do not get bad results from the so-called refrigerating process.

Few machines have come on the market under so favorable conditions as this engine met in its infancy. In 1876 the Porter-Allen was the only high-speed engine that was known on the market. Prof. John E. Sweet had built his now famous straight-line, and J. C. Hoadly had made some small, quick-running automatics, but neither were known to commerce. Mr. Porter's theories of high speed found many admirers, who were timid in putting them in practice; they were willing to accept a mean between the extremes. It was this spirit on the part of engine buyers that the Buckeye engine people met when they surprised the country with their steam engine exhibit at the Centennial Exhibition in 1876. This was the best illustration, in the engine trade, of the reaper ready for the harvest, since the early days of Geo. H. Corliss.

At that time the Buckeye folks advocated a piston speed of 500 feet per minute. It was a compromise that helped to lead up to the practice of to-day among the high-speed builders.

If Professor Sweet had gone into the manufacturing business earlier in life, the credit of putting the first single-valve automatic cut-off engine on the market would probably have fallen to him. Fortunately for the boys, but unfortunately for the steam engine interests of the country, he remained a professor too long. Years before he exhibited his engine, in 1876, he had made several of that type, which are running to-day, giving evidence that speed in a steam engine, well designed and constructed, does not destroy.

Professor Sweet has been more than an engine inventor and manufacturer—he has been an educator as well. His influence

over the younger members of the engineering profession, coupled with the excellent workmanship he puts on his engines, makes his shops one of the best manual training schools in the country.

Nothing was done in this country toward developing the single-acting engine until about 1880, when Mr. Herman Westinghouse came into the field. The engine that now bears his name was then put on the market, as a throttling engine, in the smaller sizes. This engine, in many ways, was as great a departure from established practice as any of its predecessors, in the way of design and rotative speeds, and, like all innovations, it was not met with a friendly feeling on the part of competitive builders. Possibly there may exist to-day scant courtesy toward the newer comer from its rivals; success does not always draw commendation from people engaged in the same line of business, and it would be strange if this case were an exception. If any one who has followed the steam engine trade will do a little reminiscent work, he will have no difficulty in bringing to mind a few expressions that were in vogue among the engine salesmen of ten years ago that were anything but flattering to the Westinghouse engine. An argument based on good foundation will always find believers; one based on ignorance will act as a boomerang, and come back with terrific force. The opposition to the Westinghouse acted in this way, and, no doubt, helped them into the extensive trade they now have.

This engine has many features exclusively its own. As mentioned before, the engine is single-acting, and consists of two vertical cylinders, set side by side, with the pistons at an angle of 180 degrees. A peculiar arrangement of the crank-shaft, which is placed one side of the center of the engine, to favor the working stroke, allows the builders to use a much shorter connecting rod without the evil effects of excessive angular thrust. Another result of this offset crank is to make it impossible to put both cranks on their dead centers at the same time. If one crank is directly on the center line of the engine, the other will be off. One must not get the idea that there are no points in the revolution of this engine where it will not start without assistance at the fly wheel, for there are two in each full turn, the same as in the double-acting single cylinder. While the crank offset is not enough to insure against dead centers, it is a decided help in producing even turning. Any one who has spent much time in the testing-room of the Westinghouse Machine Company has probably seen engines on foundations running, under control of the governor, with nothing on the shaft to act as fly wheel beyond a two-pound lathe dog. Of course, with the automatic cut-off there is considerable fly wheel force in the governor on the shaft. The throttling engines, that had absolutely nothing but the cranks, would run quite as smoothly under such conditions.

The valve used on these engines is of the piston type, fitted with rings to compensate for wear. The steam chest, or valve cylinder, is midway between the engine cylinders, and back of their centers somewhat. Its axis points to the center of the shaft, where the eccentric is located in the "Standard" engine. The "Junior," an engine suited to the smaller sizes, has the steam chest and valve on top of the cylinders; this is also true in the case of the compound.

These engines, like their high-speed brethren, are of the single-valve, shaft-governor type.

The self-oiling feature of this engine has done much to commend it. It is very simple, and has the merit of being positive.

The crank case is made water-tight below the main bearings, and is partly filled with a mixture of water and oil. An overflow pipe, at the right level, guards against flooding. The motion of the cranks makes a mechanical mixture of the oil and water, and bathes every bearing in a lubricant. A small pipe is run from the outer end of the main bearing to the bottom of the crank case, returning the mixture that is constantly flowing through the main bearings to the crank case. The governor on the "Standard" engine is between the cranks, and, of course, is lubricated with the other parts.

In the "Junior" and compound, the governors are outside of the crank case, and are enclosed in tight cases, which are filled with oil, insuring the same positive lubrication that the internal parts receive. The speeds of this engine are even higher than its competitors. The side-by-side cylinders, with the pistons working in opposite directions, make it well adapted to very quick running.

Mr. Westinghouse undoubtedly has perfected an engine that will remain as a distinctive type, and in time, when the existing patents have expired, we shall see his name hyphened to other builders, as we now see that of Mr. Corliss.

A more recent departure in the steam engine line has been made by B. W. Payne & Sons, of Elmira, N. Y. These people have shown their loyalty to the high-speed principle, and the admiration for many of the good features in the Corliss, to the extent of combining both in a new engine. The high-speed features that have been retained are the positive motion of valves and the shaft governor, while from the Corliss the valves and wrist plate motion have been taken. The advantages are a very low percentage of clearance, coupled with higher rotative speed.

Indicator cards from an engine of this type, 20"x28", 112 revolutions, doing its usual work, were recently sent to the writer by the engineer, with a request that the developed power be given. The M. E. P. was 50 pounds, and the horse-powers 248.

These people are probably the oldest builders of the single-valve automatics now on the market, dating from 1877. Hoadly was earlier, but did not remain in the field.

The American Boiler Manufacturers Association will hold its next meeting in St. Louis, Mo., beginning May 12. Secretary H. T. Douthett, Darragh street and River avenue, Allegheny, Pa., will furnish any desired information as to this meeting. He has issued a circular to the boiler manufacturers of the United States and Canada, inviting them to be present.

Pattern Making.

By P. S. Dingey.

BEVEL GEARS.

Before saying anything about the construction of these patterns, some explanation should be made about the lines that are required.

Fig. 1 is a section of the gear and pinion to be made, and gives the angle at which the two shafts are set. Bevel gears are usually made to run at right angles to each other, but when occasion requires they can be made to run at any angle. In Fig. 1, *a* is the angle that is chosen; the two lines representing this angle are the first to be drawn, for on these all the others depend.

Having the angle, the next things to be determined are the proportion and sizes of gear and pinion. In this case I have made the proportion about 3 to 1, pitch 1½". The gear is 26.8" diameter, having 56 teeth, the pinion 9.11" diameter, with 19 teeth. The pinion is made with an odd number of teeth, so that they shall not work into the same ones of the gear at every revolution, but shall be continually changing; the odd tooth is sometimes called a "hunting tooth."

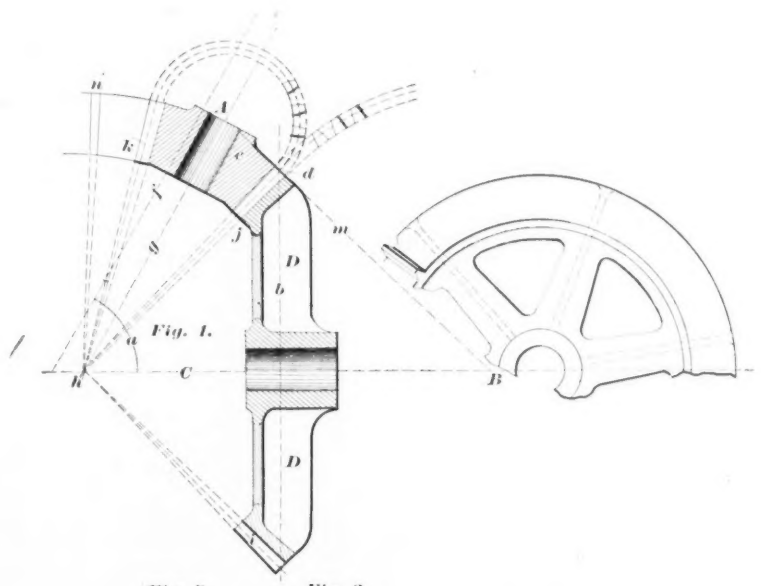


Fig. 1.

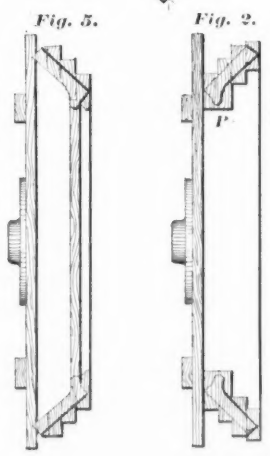


Fig. 3.

Fig. 2.

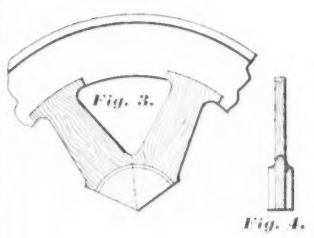


Fig. 4.

PATTERN MAKING.

The angle and the dimensions being settled, proceed by drawing the line *b* at right angles to *c*. This line *b* is the diameter and pitch line of the gear. From point *d* lay off *e* at right angles to *f*; this will be the pitch line and diameter of the pinion. Draw the center line *g* parallel to *f*; this locates the center *h*, toward which all the teeth must converge. Draw *i*, *j*, *k*, the center lines of teeth, to *h*; on these lines lay off the face of the wheels, making the ends of teeth square with the center lines *i*, *j*, *k*.

The section of the rim, arms and hub are now easily drawn. The teeth are laid out on larger circles than the diameters of wheels, the centers being *A* and *B*. These centers are obtained by producing the line representing the ends of teeth, or, in other words, making *m* at right angles to *j* until it cuts the center lines of gear and pinion at *A* and *B*. The profile of the teeth must be made as if the centers of the gear and pinion were at *A* and *B*. To get the correct thickness of the tooth on the inside, the outer thickness must be laid down at *u*, running the sides toward center *h*. The profile of the inside of teeth is made after the same manner as the outside. Having described the method of drawing out these gears, we can pass to the construction of the patterns.

The rim is built up on a face-plate in the manner shown in Fig. 2, and when the work is thoroughly dry, the inside should be turned, getting in around at *P* as far as possible. The arms are fitted in the wheel as shown in Fig. 3, which should be done before taking the rim off the face-plate. There is a thickness of about ⅛" put on each side of the arms to hold them together, also answering for fillets; see Fig. 4. Tongues should be inserted in the joints where the arms join at the center, thus making with the pieces on either side a strong job. It is the intention to leave the hub and ribs *D D* in Fig. 1 loose, so that they can be lifted with the cope, thus preventing the mold from tearing down. After fitting in the arms the rim is chucked as seen in Fig. 5, and finished on the outside ready for putting on the teeth. I have already described in the AMERICAN MACHINIST of June 30, 1888, and March 20, 1890, the manner in which gear teeth are put on, and these should be put on in a similar way.

Pinions may be built up hollow or solid; in this case it is not large enough to build hollow, so pieces must be glued together with the grain of wood running with the axis of pinion, and large enough to allow the teeth to be cut out of the same. For larger pinions, pieces can be glued around the periphery, the grain of the wood running the same way as the teeth, then turned off, and the teeth cut as if cutting them from the solid, as before.

It is amusing to any one accustomed to traveling in England to read the criticisms by visitors there, from Chauncey Depew down to the "ten-day man," who takes in the whole system at a glance. . . . We can remember very well a time when we could rail at English railways, and sighed for the American car with its back-breaking seats, a temperature of 75 degrees and a tank of ice water in the corner, the red-hot stove, headache, and the rest, but we come to know better after a while, and now have no fear of traveling any length of time in England. Most countries have their traveling service adapted to the tastes and wants of the people, and it would save a good deal of silly criticism if travelers would omit their prejudices and provincialism in studying such adaptation in other countries.—JOHN RICHARDS, in *Industry*.

The *Engineering Record* makes a good point in its criticism of the new engineering magazine, recently started in New York and christened *Engineering*. It says:

The appropriation, however, by the owners of the magazine, without modification in any manner, of the title of our English contemporary, *Engineering*, which circulates in the United States, and which is widely quoted, is an act not to be commended. This mistake may be corrected in a future number, and can be, without prejudice to the enterprise, which, under a modified title, would have our best wishes.

In an address at a dinner of the Boot and Shoe Club at Boston, Colonel Carroll D. Wright, U. S. Commissioner of Labor, said by way of illustration of the extent to which the demand for taste in design is increasing, that a stove manufacturer in Boston had paid an eminent sculptor five thousand dollars to design the ornamentation and lines of a stove that was manufactured expressly to suit those living in small tenements.

A controversy having arisen in England as to whether some knives were handled with ivory or zylonite, a workman settled it by applying a lighted match to one of the handles, which readily took fire.

According to statistics, the world's production of fine copper in 1890 amounted to 270,485 tons of 2,240 pounds each, of which the United States produced 116,325 tons, or 43 per cent. of the world's supply.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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Reform in the Navy Yards.

It is probable that nearly every citizen of the country who is not a professional politician will be glad to learn that an important reform is to be instituted in the management of the various navy yards.

It has long been known that there has been altogether too much politics connected with the navy yards of the country, and that there are too many men in them who have secured and who hold their positions by virtue of their wire-pulling abilities, rather than by any other qualities they possess.

The abuses to which this state of affairs has led have become notorious, and neither of the political parties can claim to be better than the other in this respect, since the professional politicians of each party always attend to such matters, and one political boss and wire puller is about as bad as another, regardless of political complexion.

Secretary Tracy has now issued an order declaring the places of all master mechanics, foremen, etc., at the Brooklyn yard, vacant on the first day of June, and the places are then to be filled by candidates who have passed competitive examinations designed to bring out the knowledge possessed by them pertaining to the branch of the work in which they seek positions. It is understood that the same will be done with all the other yards, later.

It was at first reported that this was to extend to all the men employed, including journeymen mechanics and even laborers, but this report has been authoritatively denied, and such a measure would, of course, be entirely unnecessary, since, if foremen and master mechanics are put in, who hold their places solely by virtue of fitness, and are thus independent of the political bosses, they will naturally select the men under them, also, without much regard to political considerations.

The men who at present hold positions of responsibility cannot, of course, complain of the new order of things, since the competition will be open to them, and their experience in the work should give them the advantage in the examinations, other things being equal; and, should any of them be successful in the examinations, and retain their places, they will occupy them upon a basis which cannot fail to make them more efficient in every way, and also make them feel more like independent and self-sustaining citizens.

Competition is to be open to any citizen of the United States, whereas, under the present regime, no one who does not live near the various yards, where wire pulling can be done at short range, so to speak, could hope for preferment.

It will be quite interesting to note what kind of men are selected by these competitive examinations. Take the master machinist, for example. Every practical man knows that he should, in order to be successful, possess qualities which, from the nature of the case, he can never prove himself to possess by any examination, nor, in fact, any other way but by actual work in the shop.

An examination, if conducted by practical men, themselves thoroughly conversant with the business, may be made to show pretty accurately just how much knowledge of the business an applicant possesses. He may thus show his ability to make necessary computations, his familiarity with the proper methods of doing machine work, erecting engines, etc.; but after all this and much more has been shown, there will still remain other qualities equally important, that no such examination will show. Among these are self-control; the faculty of deciding quickly the best thing to be done in an emergency; the ability to command the respect and confidence of men, etc.—qualities which are only brought out by actual service. The owner of a private shipyard would be pretty sure to find out if such qualities were possessed by an applicant for such a position, but he would hardly think of finding out by an oral or written examination, and, if he did judge of this matter upon the strength of a personal interview, he would probably be puzzled to put down in black and white just what considerations led him to the conclusion formed, one way or the other.

The plan which he would in most cases pursue would be to give the position to some journeyman workman in his own shop who had shown the necessary qualities, or hire from another shop a man who had been successful in a like position.

Such a course is not open to the navy department, and the competitive examinations are therefore probably the best thing possible to adopt, and will at least prove very much better than the methods pursued in the past.

Taxation of Manufactures.

One result of the present agitation of the question of taxation is the discovery that many of our tax laws operate as direct discouragers of enterprise and industry, and that it is possible, in many places, for a man who invests his capital in such a way as to do nothing or next to nothing towards the development of industries, to almost entirely escape taxation, while he who is employing his capital and his energies in such a way as to do most towards the development of industries which build up communities is taxed to the maximum, and in effect fined for his industry and enterprise. One would think that in the State of Massachusetts, if anywhere, the importance of manufacturing and building industries would be fully appreciated, and that its tax laws would long ago have been arranged in such a way as to encourage such industries. Yet a commission appointed by the Mayor of Boston to look into the subject of taxation has recently made a report, in which the grossest inequalities are shown to exist in the tax laws of that State, and that the burden imposed by these inequalities falls heaviest upon the very persons and enterprises that do most to develop and build up the community.

The commission particularly condemned the system of personal taxation, under which any one who owns anything whatever in which labor has been employed in the making, or for which labor is required for the operation, is heavily taxed, and the amount of the tax made somewhat dependent upon his honesty—the more honesty the more tax; the more dishonesty (in making returns) the less tax. Much of the taxation imposed by the State is shown to be double taxation, *i. e.*, property itself is taxed, and again the evidence of ownership of property is taxed. To illustrate: The buildings, machinery and stock of an incorporated manufacturing company may be taxed, and then each stockholder is taxed on his stock in the company, which is clearly double taxation, and a direct discouragement of manufacturing enterprise, and honesty as well; for those who are least scrupulous simply evade one tax or the other by misrepresentations, leaving the more conscientious to bear the additional burden thus imposed. The commission recommends that taxation of personal property be abolished, and all taxes placed upon real estate, which, of course, cannot be concealed, nor its value very far misrepresented, and it believes that this value would pretty accurately measure the capital put upon real estate, and that the burden of taxation would therefore fall much more equitably than now, and in a way much less calculated to discourage enterprise and industry.

Whether this be true or not, the proposition is one in which manufacturers must be especially interested. But to show that taxes may be laid upon real estate in such a way as to be unfair and burdensome, we need only relate the experience of a young mechanic of our acquaintance, who by industry and economy saved enough to buy a building lot and erect a home for himself and family upon it. He paid $650 for his lot, and the land owner, who still owned similar lots on either side of him, was assessed for taxation at $150 per lot, while our young mechanic was assessed on his lot, exclusive of the improvements, at a valuation of $500, and the vacant lot owner continuing to pay taxes on a valuation of $150 for precisely similar lots, now holds them at $1,000, the increase in value being caused mainly by the erection of our friend's, and similar houses. Thus that town is seen to be encouraging vacant lots, and discouraging the building of houses; and it works the same way with manufacturing or other enterprises, which build up the wealth of communities and increase the value of land for the benefit of the land speculator, who usually manages to escape paying anything like his fair proportion of taxation.

Undesirable Object Lessons.

We recently referred to the fact that there were in this country a class of immigrants—most of them imported—who had but little idea of gaining an end except through the exercise of brute force. Perhaps in many instances these men are not altogether to blame in arriving at the conclusion that brute force is popular here. A good many of them get their first lessons by working for railroad companies, and very undesirable lessons they sometimes are—tearing up track and destroying property generally. A case in point has recently occurred in Jersey City. It may be said, in passing, that Jersey City is pretty completely dominated by railroad interests, and appropriating the property of the city by some one of the railroad companies is of so common occurrence as to fail to excite any particular comment. But in the instance to which we more particularly refer, the trouble is between two railroad companies, and appears to be mainly due to the efforts of one of these companies to prevent the other from establishing direct communication with parts of the city in a way to profit itself and benefit the public. In pursuance of its plans, this last mentioned company built a rather substantial fence, something like one thousand feet in length. This fence was scarcely completed when the other company sent, at night, a large gang of foreign laborers—large enough to resist any attack likely to be made—to tear it down and throw its component parts into the canal. This was accomplished, and the forces withdrawn without loss of life. At this writing the forces of the two companies are confronting each other along the line of the proposed extension, peace, so far as breaking heads and other similar diversions, being maintained by the superior numbers of one of the contesting parties.

About the only amusement they seem to have just at present is getting a hitch around an occasional tie and testing the tractive power of a locomotive in scattering things generally.

It is rather hard to conceive of a better school in which to teach ignorant men, unable to speak the language of the country, the lesson of using force for their own purposes. Quite naturally enough, they conclude that that is the rule in America.

Literary Notes.

RUBBER HAND STAMPS, AND THE MANIPULATION OF RUBBER. A Practical Treatise on the Manufacture of India Rubber Hand Stamps, Small Articles of India Rubber, The Hektograph, Special Inks, Cements, and allied Subjects. By T. O'Conor Sloane, A. M., E. M., Ph. D., Author of Home Experiments in Science, Arithmetic of Electricity, etc.

Much interesting matter is contained in this little book of 146 pages. It begins by giving briefly the sources of India rubber, short historical sketches, and the manner of collecting the rubber. The properties of unvulcanized and vulcanized rubber are briefly stated; the manufacture of masticated, mixed sheet and vulcanized India rubber is explained, and the methods of making stamps, types, and various small articles of rubber are described. The manufacture of a substitute for rubber stamps, which stands the severe usage in post offices, is described in detail. The hektograph, an apparatus for obtaining multiple copies of writing, is given in several modifications, and then follows a chapter containing receipts for cements, such as cements for cuts in bicycle tires, rubber belts, etc.; bicycle tire cement to fasten tires to rims; cement for

paper boats and for mending rubber goods; waterproof cement; glue to fasten leather, etc., to metals; marine glue and various other receipts. Another chapter is devoted to various kinds of ink, such as is used for rubber stamps, hektograph, and other purposes. In the last chapter will be found some interesting and practical notes relating to rubber, emery wheels, etching on metal and glass, and other subjects. The whole matter is presented in a way which will at once interest the reader, and can be understood by those who are not familiar with the subjects, and it will undoubtedly convey much useful information to many who are interested in the above subjects. The book is published by Norman W. Henley & Co., 150 Nassau street, New York. Price $1.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(194) W. T. R., Holliston, Mass., writes: What studies and what branches in mathematics are required to become a mechanical engineer? *A.*—See our issue of February 19. 2. Where should I apply for examination and license? *A.*—Mechanical engineers do not need a license.

(195) W. F. L., Philadelphia, asks: Please give me the best angle for a friction clutch of the cone order. *A.*—The angle of obliquity of the conical surfaces should be just great enough to prevent any risk of their becoming jammed against each other, so as to prevent disengagement, and for that purpose an angle of 10 degrees is sufficient.

(196) A. M., Norfolk, Va., writes: Please inform me as to the best method of heating a church—should it be steam, hot water, or hot air? Cost, efficiency, durability, economy and health is to be taken into consideration. Some say it is an open question as to which plan is the best. *A.*—Each system has its advocates, and each has its own peculiar merits, which make it more suitable for heating under certain conditions than the other systems. For heating a church we prefer to use steam.

(197) A. H. B., Du Quoin, Ill., writes: Please inform me as to the best methods employed for mounting blue prints, to be used in the shop to work from. *A.*—In many shops the blue prints are simply tacked to wooden boards about $\frac{3}{8}$ to $\frac{1}{2}$ inch thick. We should advise to make all the working drawings on sheets not over 12x18 inches whenever it is possible to do so, and then make the blue prints on comparatively thick paper. Blue prints of this size on thick paper need not to be mounted; they can be conveniently hung up by an eye attached to the edge of the sheet or a hole punched through the sheet. Larger blue prints should be tacked to a board.

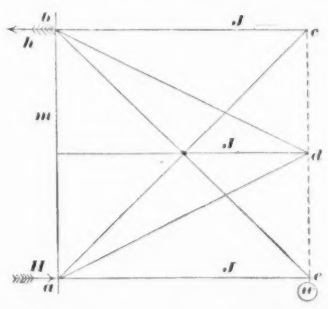
(198) F. D. M., Ft. Dodge, Iowa, writes: We have a cupola that does not give us satisfaction; it does not melt fast enough, and we wish to get at the cause of the trouble. We have a No. 5 Sturtevant blower; it is 50 feet from the cupola, and the pipe has five elbows. We believe that this is the cause of the trouble. *A.*—Better results will, of course, be obtained by making the pipe from blower to cupola straight, and as short as possible, and avoiding elbows. You do not give the size of cupola, or the amount of metal melted per hour; it may be that the cupola is too small for the work you wish it to do.

(199) C. E. D., Springfield, Ohio, writes: I wish you would tell if my solution of the following valve problem is correct. The stroke of engine is 3 inches; lead, $\frac{1}{8\frac{1}{2}}$ of an inch; cut-off at $\frac{3}{4}$ of the stroke, and exhaust at $\frac{7}{8}$ of the stroke; width of steam port, $\frac{1}{4}$ inch. I am to find the eccentricity of the eccentric, outside and inside lap; the steam port is to be opened to its full width. The following is my answer: Outside lap, $\frac{1}{2}$ inch; inside lap, $\frac{1}{8\frac{1}{2}}$ of an inch; eccentricity of eccentric, $1\frac{5}{8\frac{1}{2}}$ inch. *A.*—Your solution is not correct. The outside lap should be $\frac{15}{32}$ of an inch; eccentricity of the eccentric $\frac{31}{32}$, making the throw equal to $\frac{31}{32} \times 2 = 1\frac{15}{16}$ inch. Without any inside lap the valve will open the exhaust at about $\frac{1}{16}$ of the stroke, and if the release is to occur at $\frac{7}{8}$ of the stroke you will need inside clearance of nearly $\frac{3}{16}$ inch instead of inside lap.

(200) T. McB., Philadelphia, Pa., asks: Will a steamboat go faster through salt water than through fresh water? The answer is to settle a dispute, as one party claims that the displacement in cubic feet will not be as great in salt water as in fresh water, and therefore easier to force the boat through the former. The other party claims that there is a greater friction in salt water, which offsets the gain of the smaller volume of displacement. *A.*—It is true that the friction in salt water is greater than in fresh water; and it is also true that the volume of displacement will be less in salt water than in fresh water. We are inclined to believe that it requires a greater power to overcome the resistance of friction in salt water than is required to overcome the greater depth of flotation in fresh water, and, therefore, it will take a greater power for propelling a boat in salt water. As far as we know, experiments are wanting to determine the difference, but it will probably be so small, that, for practical purposes, it may be neglected.

(201) W. J. R., Springfield, Mass., writes: There was an article in your paper relating to hardening steel, which I would like to have explained. Your correspondent states how he hardened some twist drills by heating them in a lead bath to a temperature of about 700°, the lead being a little more than melted. Then he took the drills out of the lead and plunged them into a salt water bath; he would have about the same degree of heat as would be obtained by heating a piece of steel to a very pale blue. Now, suppose we plunge this piece of steel instantly into the bath, would it harden sufficiently for a twist drill? *A.*—The result obtained by your proposed plan is very doubtful; we believe it will not harden the twist drill satisfactorily. You seem to overlook the fact that our correspondent states (in our issue of February 5) that he plunged the drills in the salt water bath for an instant only, and while they were yet sufficiently hot to raise a smoke, he plunged them into an oil bath, and kept them there until as cold as the oil. Although this method of hardening proved to give the desired results in this particular instance, it does not follow that similar results will follow in all cases. Success depends much on the proper temperature to which a particular kind of steel will have to be heated, and the purpose for which the tool has to be used. Experience is required in the tempering of steel.

(202) B. C., Pittsburgh, Pa., writes: A well-known mechanical pocket-book, referring to the strains in cranes, says: "The horizontal strain in the cap b is equal to that



in the shoe a." In the annexed diagram, m is the mast; J, the jib. Let c, d and e represent the different positions of the jib on the mast, and w the weight suspended at the same distance from the center of the mast. I think there is not as much strain in the direction of the arrow at b when w is suspended at e, as when suspended at c. If w be 10 pounds, and $a\,b$ equal $a\,e$, there will be 10 pounds horizontal strain at b; but if $a\,b$ be made twice $a\,e$, then it is evident that there will be only 5 pounds stress at b. Now the question is, will there be only 5 pounds at a in that case? Please give a rule for finding the strains at a and b. *A.*—Problems of this kind are good examples of the application of the principle of moments, by which you have found the force applied to the top b of the mast. For instance, let h represent the horizontal force acting at the top of the mast, preventing it from toppling over, and let a represent a point in the bottom of the mast, about which the force h and the weight w tend to turn the crane; this point a is then the origin of moments. Now the moment of the weight w is numerically equal to the product of the weight w into its arm; that is to say, into the line drawn perpendicular from the origin of moments to the direction in which the weight acts; if, for instance, w is 10 pounds, and the distance from the mast to the weight is 3 feet, then the moment of w is equal to $10 \times 3 = 30$ foot-pounds. The moment of the force h is found in the same way; that is to say, we multiply the force h by its arm or distance above a, and for equilibrium, the moment of the force must be equal to that of w, namely 30 foot-pounds. If now the mast stands vertically, and is 6 feet long, then it would be evident that the force h must be equal to $\frac{30}{6} = 5$ pounds, and this result agrees with yours. The whole of the foregoing operation can be expressed by symbols. Let h represent the horizontal force in pounds acting at the top of mast; $b\,a$ the length of mast in feet; $a\,e$ the length of jib in feet; and w the weight in pounds; we then have $h \times a\,b = w \times a\,e$, hence

$$h = \frac{w \times a\,e}{a\,b}.$$

Notice here that the distance from the bottom of mast to the jib does not enter into the calculation; and indeed it should not. Hence we conclude that, no matter whether the jib is placed at e (at the bottom), or at d (at the center), or at c, at the top of the mast, the horizontal force h remains always the same, so long as we do not change the weight w, the length of the jib, or the length of the mast. Of course, in the foregoing illustrative remarks it must be understood that the jib is placed horizontally, and the mast vertically. Now suppose we suspend the crane so the whole arrangement tends to turn around the point b, or, in other words, suppose the origin of moments is at b, and let H be a horizontal force acting at the bottom of the mast holding the system in equilibrium, then the moment of the force H is again equal to the moment of the weight w, or expressed in symbols, we have $H \times a\,b = w \times a\,e$; hence $H = \frac{w \times a\,e}{a\,b}$, which shows that $H = h$. From this we conclude that the horizontal forces acting at the top and bottom of the mast are equal, and since these forces are parallel, they constitute a couple. If the force h is equal to 5 pounds, as we have found it to be in our example, the force H will also be equal to 5 pounds. These results agree with what you have seen stated in the pocket-book to which you refer. Here, of course, the friction at the bottom of the mast, due to the weight of the crane and load, is neglected.

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MANUFACTURES.

A mill for rolling copper wire is being built in Braddock, Pa.

It is rumored that a large steel plant is to be built at Madison, Ind.

A company will establish an iron foundry and machine shop at Orange, Tex.

It is stated that a Philadelphia syndicate will erect a cotton-mill at Texarkana, Ark.

It is stated that efforts are being made for the establishment of an ice factory in La Grange, Ga.

The Elliston Machine Works Company have established a foundry and machine shop at Elliston, Va.

Jenkins Brothers have moved their Chicago office from 54 Dearborn street to Nos. 31 and 33 N. Canal street.

Negotiations are now pending with Philadelphia (Pa.) parties for the erection of a cotton-mill at Texarkana, Ark.

The Vance Cotton-mills, of Salisbury, N. C., have a capital stock of $75,000. Work has been commenced on the mill.

It is reported that a company with $60,000 capital will be manufacturing wire nails, at New Philadelphia, Ohio, by July 1.

The Queen & Crescent will not remove its Somerset (Ky.) shops. A new roundhouse and additional shops will be built at that point.

William Yelland will erect a machine shop in Philadelphia, 24x40 feet, on the east side of Tacony street, north of Orthodox street.

Harris Brothers, of St. Paul, Minn., are at the head of an enterprise that proposes to build a large rolling-mill at Minneapolis.

A wire fence factory will probably be established at Knoxville, Tenn. The secretary of the Chamber of Commerce can give information.

It is stated that the Lattimore Machine Company, St. Louis, Mo., will build a new factory on East Elwood street, on land donated by the city.

E. H. Brammel, of Camden, Me., is to build a two-story building, 46x52 feet, for a brass and iron foundry, and machine and wood-working shop.

The Hyer-Sheenan Electric Motor Company has been incorporated at Stafford Springs, Conn., to manufacture motors, governors, and other specialties.

The Wiley & Russell Mfg. Co. (Greenfield, Mass.,) has issued an enlarged catalogue and price list of taps, dies, bolt cutters, and other machinery and tools.

Charles Balderston, 820 Walnut street, Philadelphia, an architect, has prepared drawings for a large paper-mill, to be built for H. McInnes, at Norriston, Pa.

The Enterprise Manufacturing Company, of Philadelphia, have broken ground for a one-story foundry, 58x104 feet, on the east side of Bodine street, south of Dauphin.

It is stated that P. Maguair and G. S. Moore have received a proposition from a Pittsburgh (Pa.) company for the removal of a 70-ton iron furnace to West Pineville, Ky.

The Bessemer (Ala.) Machine and Foundry Company have commenced the manufacture of agricultural implements, and will enlarge their plant and put in additional machinery.

The North Carolina Steel and Iron Company, of Greensboro, N. C., will build a blast furnace and merchant bar-mill at once, of which J. D. Kase, of Danville, Pa., is to be manager.

Messrs. Luker & Smith have organized as the Russellville Foundry and Machine Company, and will, it is stated, establish an iron foundry and machine shop at Russellville, Ark.

R. M. Clough, manufacturer of the Clough patent cutter for the teeth of gear wheels, has moved his business from Meriden, Conn., to Tolland, Conn., in order to obtain better facilities.

The Georgia, Carolina & Northern Railway Company (office, Athens,) is reported as having optioned 80 acres of land at $32,000, near Atlanta, Ga., and as to erect machine shops there.

The Globe Iron Roofing and Corrugating Company, of Cincinnati, Ohio, is reported as having purchased and as to put in operation the Swift's Iron and Steel Works at Newport, Ky.

Benj. Middleditch of 256 Harper avenue, Detroit, Mich., writes us: "I am about to establish a machine shop here for the manufacture of special machinery and to do general jobbing."

The Lownes Manufacturing Company has been organized at Orlando, Fla., to operate iron foundry and machine shops, and to manufacture the Lownes pipe wrench. The capital stock is $300,000.

Parties having purchased a controlling interest in the Florence Stove and Manufacturing Company, of Florence, Ala., will improve the plant, and put in machinery for the manufacture of plows.

The Dean Steam Pump Works, Indianapolis, Ind., have issued a new catalogue of pumps and pumping machinery. The catalogue is well illustrated, and contains tables and other interesting information.

The Riverside Iron Works, of Wheeling, W. Va., are having an addition, or wing, constructed of corrugated iron, built on the east side of their tube works, at Benwood, with dimensions of 240x100 feet.

The Beadle & Kelley Co., of Troy, Ohio, manufacturers of agricultural implements, has sold its business to the Common Sense Engine Co., of Springfield, and the plant will be removed to the latter place.

The ice factory and cold storage warehouse of the Paris (Ky.) Ice Manufacturing and Cold Storage Company will be 60x100 feet, and have a capacity of 25 tons of ice per day. The capital stock is $25,000.

Perkins & Co., Grand Rapids, Mich., have issued a circular illustrating and describing their draw stroke trimmer, for the use of pattern makers and other wood-workers. Letters from users of this tool are appended.

The Steinhilber Combination Car Company, of Chicago, has been incorporated, to manufacture and sell stock, freight and coal-chute cars; capital stock, $500,000; incorporators, Wm. Fuller, M. B. Mills and George A. Fuller.

Articles of incorporation have been filed by the Northwestern Engineering and Machinery Company, of St. Paul, Minn. The capital stock is $50,000, and the incorporators are Charles A. Daigh, W. G. Strickland and J. M. Badger.

At Colorado Springs, Col., the Rapid Transit Company are about to add to their plant, and will build, in connection therewith, a machine shop, and equip it with new and improved tools, among which are lathes, drill, wheel, press, etc.

The Brunswick (Ga.) Foundry, Machine and Manufacturing Company has built and added to its plant additional machinery, including a hydraulic wheel press, boiler rolls to bend iron 8 feet thick, traveling crane to lift 20 tons, etc.

Virgil Powers, J. A. Carlton and H. L. Johnson have incorporated the Carlton-Johnson Railway Signal Company, at Atlanta, Ga., to manufacture the automatic electric block system of railway signals, etc. The capital stock is $100,000.

The Virginia Car Company, with a capital stock of from $100,000 to $1,000,000, has been incorporated, at Glasgow, Va. Col. A. S. Buford, of Richmond, is president, and among the directors are ex-Gov. Fitz Hugh Lee and Col. W. A. Anderson.

N. P. Bowsher, South Bend, Ind., has issued a circular describing his patent balancing ways, illustrated in our issue of April 2. He informs us that these ways are finding much favor in machine shops having rotating parts of machinery to balance.

The American Mining and Milling Machine Company, Chicago, is a new concern, to manufacture mining, milling and other kinds of machinery, with a capital stock of $1,000,000. The incorporators are William Armstrong, Frank B. Dyche and Lawrence Harmon.

The El Paso (Tex.) Foundry Company are building a new foundry and machine shop, equipping the same with new tools. This is a modern plant, in the hands of live men, who thoroughly understand the business, together with the wants of the people in that section.

The Toledo Bridge Company, of Toledo, Ohio, has been incorporated, with a capital stock of $100,000, to manufacture and construct bridges and structural iron and steel works. Incorporators: James A. Huston, E. B. Smith, G. P. Waddorf, L. E. Clark and E. W. Toleston.

The Salisbury (N. C.) Cotton-mills, at a recent meeting, decided to erect the additional cotton-mill lately mentioned, and will issue $75,000 of additional stock for that purpose. The new mill will be 300 feet long, 125 feet wide, with engine and boiler-house, and have 300 looms and 7,500 spindles.

The Hayden & Derby Manufacturing Company, 111 Liberty street, New York, manufacturers of the Metropolitan automatic injector, have established agencies with The Ahrens & Ott Manufacturing Co., Louisville, Ky., Ripley & Bronson, St. Louis, Mo., and Trimble & Lutz, Wheeling, West Virginia.

The John F. Byers Machine Company, of Ravenna, Ohio, recently organized with E. R. Crowell, president; Marvin Collins, secretary and treasurer, and J. F. Byers, superintendent, has just finished the construction of its brick machine shop, 28x120 feet. It is the company's intention to add a large foundry building the coming summer.

The Cold Rolled Steel Company has been organized in Pittsburgh, Pa., and application will be made for a charter. The incorporators are W. H. Nimick, H. H. Jack, James W. Tyson, Jr., W. J. Howard, Jr., and Samuel B. Shoemaker. The capital stock has been fixed at $50,000, with privilege to increase. It is the intention to make all shapes of cold rolled steel, including sheets, plates, round, half-round, half-oval, etc.

The British and European Patent Agency, F. W. Barker, manager, 252 Broadway, New York, has issued, for free distribution, an "Epitome of the World's Patent Laws and Statistics." It gives the cost of taking out a patent in all countries where patent law exists, and other information that the inventor should have in relation to patents, and the chief products of the several countries.

An ordinance has been introduced in the New Orleans (La.) City Council asking that privilege be given L. W. Brown to erect foundry and machine shop, dry dock, shipyards, etc., on the river front at Pine street; also to grant switch privileges. A company, to be known as the Audubon Iron Works Company, Limited, is proposed to be established under the ordinance, and the passage of the bill is now awaited to formulate plans for the construction of the buildings, dry dock, shipways, etc. The buildings provided for will cost about $750,000, and the dry dock about $250,000. The company will probably have a capital of $1,000,000.

The Detroit Radiator Co. (Detroit, Mich.,) have commenced operations at their new shops located at the junction of the Grand Trunk and Michigan Central Railroads. The company own eight acres of land at this point, and the buildings are so arranged that all the departments are reached with trackage, of which there is some 2,300 feet. There is also a complete inside narrow gauge system. The buildings are all of brick on stone foundations, with either slate or tar and gravel roofing, and sizes are as follows: Foundry, 250 feet by 100 feet, with trussed roof and no posts; charging-room, 33x30 feet, containing hydraulic elevator; core-room, 100 feet by 50 feet; cleaning-room, 50 feet by 50 feet; machine-room, 400 feet by 50 feet; engine and boiler-room, 75 feet by 30 feet, with blacksmith shop attached. The motive power consists of a 125 H.-P. Armington & Sims engine, supplied by three boilers 60 inches x 14 feet. Stack is of brick, 85 feet high with a 5-foot square flue. All of the buildings are heated by steam, requiring about 6,000 feet of radiating surface. An artesian well supplies water for all purposes, and is pumped by an 8"x36" deep well pump into an immense tank, thence pumped by a 12"x8"x10" Duplex fire pump through an elaborate system of water-works; and as a pressure of 120 pounds is carried night and day, it affords complete fire protection. A complete arc and incandescent electric lighting system will be put in during the summer.

Cleveland Shop Notes.

(Editorial Correspondence.)

One of the new enterprises of Cleveland is that of the Hackney Hammer Co., where they are building a power hammer (driven by belt) the transmission from crank-shaft to hammer tup being by means of a cylinder which is supplied with an air-cushion each side of the piston which works freely in the cylinder and by the piston rod is connected to the hammer the same as in the familiar steam hammer.

MODERN SHOP METHODS.

I need say little about the hammer itself at this time, for we shall probably soon give an illustrated and detailed description of it, when our readers can judge for themselves as to its merits; but the method adopted for building them is worthy of note, as being one of the best examples of the proper way to start in to the manufacture of a machine in which there is the confidence necessary to warrant the outlay for the machinery and tools. The shops are not large, as modern shops go, but are very well arranged, the offices being in front, on the ground floor, and opening out directly onto the erecting floor, which is remarkably well lighted, exclusively by glass, in the roof. A passage-way at one side of the offices admits of teams being driven directly from the street to the erecting floor. A traveling crane covers this floor, and along one side is a vise bench, while at the other is the floor which is devoted to machine tools, this floor being about three feet above the other, but all in the same room, *i. e.*, without any partition between them.

MILLING AND BORING.

The only machine tool on the erecting floor is a large milling and boring machine, built by the Niles Tool works, which has a massive upright, having 9 feet of horizontal travel on the bed, this upright carrying on its face a saddle having 6 feet vertical travel and carrying the boring bar, which is horizontal, and has 48 inches traverse. At one side of the machine and near the floor is a circular table on which work may be fastened and which can then be turned in any position without unfastening from the table. With the frame of a hammer mounted on this table nearly or quite all the machine work is done upon it before it is taken off. Holes are drilled or bored, and milling cuts of all kinds taken. The air-cylinder spoken of is moved up and down by the crank, and slides in the guides which are at either side of the machine, and the hammer tup slides in the lower part of the same guides, the room required for both these making the guides quite long proportionately. The guiding surfaces are not formed directly in the frame, but guides are put into recesses formed to receive them, and these, with the entire flat surfaces, are milled in this machine, a cutter passing upwards on one side and down the other for roughing, while for finishing, a cutter is used which is of the right diameter for finishing both sides at once passing through, some of these cutters being as much as 16" diameter, 8½" face. The teeth are inserted in such a way that they may be set out and reground to size or replaced, and thus it is proposed to maintain standard sizes and interchangeable parts. This principle of milling is carried all through the work to an extent which is rarely equaled on work of this character, and the result of it, both from the mechanical and from the commercial point of view, is very satisfactory. The hammer seems to be a case in which the milling operation can be applied to the very best advantage, and excellent use has been made of the opportunity.

CLEVELAND TWIST DRILL CO.

At the Cleveland Twist Drill Co.'s place they were found to be very busy, and with a business that Mr. Cox the President, said was constantly increasing, so that continual enlargements were necessary. By the vacation of a part of the building in which they now are, which is expected to occur soon, they will have double the room now occupied. At present seventy-five to eighty men are employed, chiefly, of course, on drills, though some other tools, such as reamers of various kinds, are manufactured.

Of course many things are to be seen here which are interesting to the mechanic, and I shall try to give an idea of some of them, especially such as are different from the practice in other similar establishments.

MILLING SPIRAL GROOVES.

After the stock is cut up to the proper length and pointed by machines designed for the purpose, but which need no detailed description, the milling of the spiral grooves is done by special machines, which, to speak candidly, did not impress me with their gracefulness or beauty, but which, nevertheless, seemed very efficient, which, of course, is much more important. The drill blanks are held in a chuck which is at one end of a long spindle, the other end of this spindle being fitted with a large cylinder, in the surface of which there is cut a spiral groove which corresponds to the spiral to be cut in the drill. A worm-wheel is fitted to this cylinder and rotates it and the spindle by a feather, which allows the cylinder to pass through, or, in other words, to be fed forward by the spiral groove into which a stationary swiveling key is fitted to give the feed. In other words, this cylinder is simply a duplicate of the drill to be cut, except that its diameter is much larger, and consequently the angle of the spiral much less, and the grooves are proportionately smaller.

Both the grooves are cut at once, one of the cutters operating under the blank while the other works on top, there being two heads, which are permanently fixed on the bed of the machine at the proper angle. Each spindle is mounted in an eccentric sleeve, which, as the spindle with the drill blank advances, is turned to draw the cutter out so as to give the increased thickness at the center towards the shank. This turning of the eccentrics is accomplished by levers which are attached to them and which are worked by rods which are pushed forward by a collar on the advancing spindle. This same collar is made use of for automatically releasing the feed at the proper point. Each machine is designed especially for drills of certain sizes, and some of them are never used for more than one size. There are twenty-five of these machines now in use in the works and eight more are being built. Lubricant for the cutters is supplied from a large tank which is kept filled by a pump, pipes leading from this tank to all the machines which require it.

OTHER SPECIAL MACHINES.

Most of the machinery is special, the most notable example of this being a group of lathes which are used for turning drill blanks to size. In these lathes the top of the bed inclines away from the operator, and the carriage is placed on what may be called a rail which is attached to the front of the bed and swivels in a vertical plane upon a pivot at the center, clamps being provided at each end. This rail resembles that of a planer, and the carriage bears some resemblance to the saddle or head of a planer. The tool, instead of cutting in front of the work as usual, cuts on top of it, and as the rail upon which the carriage slides swivels in a vertical plane, tapers are thus readily obtained. With special devices to take the place of dogs for driving the work, and other features for facilitating handling of the machine, it was demonstrated that the work could be done on these lathes for about two-thirds the cost of that done on the regular commercial lathes best adapted to the work.

The burr left by the grooving cutter, is, on the small sizes, removed by a file, the drill being revolved rapidly in a speed lathe. One of these machines had a Beach drill chuck in the spindle, which was being used for this purpose, and this chuck had been made automatic by simply removing the threads by which the shell is ordinarily made to move the jaws, and the shell was moved directly forward and back without being turned, connection being made to a foot treadle, by which it was done without stopping the machine.

A UNIQUE FILE.

In filing the drills in this way, it is, of course, necessary that the file should be of sufficient width so that it will not go down into the grooves of the drills, and thus "dub" the corners off. I noticed one man using a dead smooth file for this purpose which measured 4 inches wide and 10 inches cut; a rather remarkable file, and one which at a single sweep or two smooths an entire drill.

For grinding the cutters which mill the grooves, there is a special machine, the grinding spindle of which is vertical, with the wheel at its lower extremity. The cutter is placed on a stud, which is mounted on a sliding carriage in front of the wheel, this carriage being moved to and from the wheel by templates, which are the form of the cutter to be ground, but much larger.

TESTING.

A plan for testing drills is in use here, which seems well calculated to show just what results may be looked for when the drills are put to actual use.

Like most other large users of steel, Mr. Cox declares that, notwithstanding the claims of the steel men to the contrary, they do not furnish uniform steel, and that, as a consequence of their not doing so, each lot of drills has to be treated in accordance with what has been previously determined with regard to them, by hardening and tempering a few experimental ones from the lot and testing them. That particular lot is then hardened and tempered without much reference to preceding lots, and after each lot is finished a number of them are selected at random, and used in drilling a flat bar of

steel of definite thickness. A record is kept of the performance of each drill in doing this, and as all the tests for a given size of drill are made as nearly as possible alike, a very good idea is had as to how the work is coming out. Another important feature of the case is, that frequently a number of drills by other makers are purchased from the stores, and subjected to the same test; the results being made a matter of record, are, of course, valuable to the company.

GROOVING REAMERS.

Part of the business of the company is the making of hand reamers, and these are milled four at a time, being placed on centers side by side in a fixture which fastens to the platen of the ordinary plain milling machine. The flutes are cut with a gradual increase of the space between them, half way around the reamer, the other half being a duplicate of this, so that, though the teeth are diametrically opposite each other, they are irregularly spaced. An index plate is used for this, which is spaced irregularly, and a dial on the screw which raises the knee gives the proper depth, which, of course, differs for each different width of space. After the four cutters, which are spaced properly on the arbor, have passed over the reamers, cutting a flute in each, they are all turned just half a revolution, and another cut made just like the preceding one, and the flutes are thus cut in pairs of the same width and depth until the cutting is completed, a rack which slides along near the bottom of the fixture engaging with pinions which are on the four shafts, and causing them to move together when the index plate is turned. An excessively long rack is not required for this, because the reamers are turned first one way and then the other, never making to exceed one-half revolution plus one space.

SOME CURIOSITIES.

An inspection of the stock-room, where finished drills not immediately shipped are kept, reveals the fact that there are some curiosities connected with this business, which the machinist working in regular shops, where there is some idea of having things about right, is apt not to know much about. There are many more varieties of shanks and different proportions between shanks and drills, than are usually seen in machine shops, and some of these, I am free to say, are nothing more nor less than mechanical monstrosities—a fact which the makers are as well aware of as any one else, but say they must supply what the trade demands. I saw in this stock-room twist drills one inch diameter, and about the regular length, but having a straight round shank only $\frac{5}{8}$ inch diameter, and near these were drills $\frac{1}{16}$ inch diameter, with round shanks $\frac{5}{8}$ inch diameter. It should be said that such drills are used mostly by men who are not machinists, and of course have a very limited knowledge of the eternal fitness of things as applied to proportions of twist drills and shanks.

A TWIST DRILL USER.

Many of them are used by such a man as Mr. Cox noticed one morning working on the new arcade building in Cleveland—a building, by the way, which is well worth a visit by those who are interested in fine constructions of that nature. There is a good deal of iron-work in the building, and Mr. Cox, happening to be there one morning while it was being put up, noticed a man drilling with a twist drill in a hand-brace. He was turning the drill backward, and occasionally removing it from the hole to blow the dust out—no chips there, of course. After watching him a moment, Mr. Cox asked him if he did not think that drill would work better if it were turned the other way? The man didn't see but what the drill "wus wurkin all roight." "Well, but," says Mr. Cox, "I am in the business of making those drills, and am consequently interested in the matter, and I know that they are made to work the other way, and will work better the other way if you would only try it." "Well, now," the man said, "it all depinds an how the p'int is fixed."

SOME WHO HAVE LESS EXCUSE.

But not all those who do absurd things with twist drills have as good an excuse for the doing of them as this man probably had.

There are three shops of the Pennsylvania system that have each a different shank for twist drills, so that the drills made for one shop will not answer for either of the others, though they are supposed to be under the same supreme mechanical authority, and are owned by the one company, which buys drills for all of them.

Years ago, when William Sellers & Co. went into the business of building tools specially adapted to railroad use, they adopted a standard shank for twist drills, and made the spindles of their drill presses to suit it. This shank is tapered $\frac{1}{8}$" to the foot, and there is a key to secure greater driving power, all the dimensions of this shank being reduced and kept to a standard which is one that is recognized by drill makers and other tool builders. Not long ago a mechanical official of one of the most prominent systems of railroads ordered a lot of drills, and in the order specified the shanks that were to be on them, not by name as such and such a standard shank, but by giving the dimensions of all the parts in thousandths of an inch. The specifications agreed perfectly in every particular with the Sellers standard shank, except that at one end there was a variation of one and a half thousandths in diameter. Some doubt was felt as to the proper way to fill this order. It was evident that the shank ordered had its origin, at any rate, in the original Sellers shank, and, after weighing the matter carefully, it was decided to give the movement toward the adoption of standard sizes the benefit of the doubt, and make the shanks to conform to the standard; a course which most any mechanic similarly situated would be apt to pursue. The drills were sent out, and were soon after returned, with the information that the mechanical department of the —— road knew what was wanted and would have it; and thus another "standard" drill shank is added to the list, to the annoyance of everybody concerned in either making or using them, and for the depletion of the pocket-books of those who have to pay for them, and for the drill spindles and collets in which they are used.

NO STANDARD WANTED.

Another instance of the same kind was in connection with ratchet drills. The two ratchet drills that are most familiar, and are most used in this country, have holes in them for the reception of the drill that are very nearly alike, the size and taper, etc., being in fact just alike, the only difference being that one of them is carried up a little further at the small end. By drilling the other one out a little at the bottom, drills which fit one will fit the other, and, if so made, any one who had either of these ratchets could go to any hardware store and buy drills to fit them, and the stores would not have to carry stocks for both. The change could easily be made, and, so far as any one can see, would be beneficial alike to the maker of the ratchets, to the drill manufacturer and to the user. Letters were addressed to the makers, setting forth these points, and asking if uniformity could not be brought about. Each replied that he would not change, and that he did not see why the drill manufacturers could not make the drills to fit his ratchets.

THE CLEVELAND CITY FORGE.

It would hardly be expected that the establishment making the heaviest forgings made in the country would be found in a place as far removed from tide-water as is Cleveland, but many of the heaviest shafts used in steamers navigating salt water were made here by the Cleveland City Forge and Iron Company, there being no other place where they could be made.

HEAVY HELVE HAMMERS.

Nasmyth, when he invented the steam hammer, thought he had sounded the death-knell of helve hammers, and on the leaf of his sketch-book, containing his first drawing of the steam hammer, is a sketch showing the helve trip-hammer in the form of a man with his head on the block, Nasmyth himself being represented as an executioner, who, with uplifted axe, was in the act of beheading him. Nevertheless, small trip-hammers are used to-day by the thousands, and that large helve hammers are still used to good purpose can be seen at this establishment, where they have twelve of them that are monsters. One just being put in at the time of my visit is supposed to be the largest helve hammer ever built, its total weight being about 60 tons. The helve, which is of wood, is 32 feet long, and the total weight of the striking parts is about six tons. The die block weighs between 25 and 30 tons. The hammer is worked by a steam cylinder, which is vertical, and placed forward of the trunnions. It is 48" diameter. The man who makes the forgings on such a hammer seldom really touches anything about it or the work. A number of other men handle the work, directed by the motions of his hands, and a boy stands at the valve which admits steam to the cylinder, and, directed in the same way, regulates the stroke. The new hammer was built by the Cleveland Shipbuilding Company. Some of the other hammers approach this one in size, but none are quite so large.

A LARGE STEAM HAMMER.

There are a number of upright steam hammers, the largest of these being built by Frederick B. Miles, now of Bement, Miles & Co. Its total weight is about 200 tons; its foundation is 51 feet deep. The distance between the legs is something over 16 feet; the stroke 8 feet, and the weight of the falling parts over 10 tons. It is served by two steam jib cranes each capable of handling 80 tons, and a switch from the railroad runs into the building within reach of the cranes. The smaller hammers are ranged along between this one and the machine shop, a track being placed in front of them by which forgings can be delivered to any of the heavier tools.

MACHINE TOOLS.

These consist of lathes, planers and slotters that are capable of handling such work as comes from the hammer, among them being a slotter built by Hewes & Phillips, of Newark, illustrated in our issue of April 5, 1884. This tool, when I saw it, was shaping up a forging, which was to be used about the steering gear of one of the new cruisers, and was taking off a chip $2\frac{1}{2}$ inches wide, and about $\frac{1}{4}$ inch thick. Mr. Wm. Schneider, the man in charge of it, said it had taken them up to $3\frac{1}{2}$ inches in width. He said that English mechanics who had been to the works, and seen it, said that they had seen larger and heavier slotters in England, but none that would take such heavy cuts.

The largest forgings yet turned out at these works were the rolls for the Mare Island Navy Yard. They finished to 32 inches diameter, and were 35 feet long over all; their forged weight being something over 40 tons each. A number of three-throw interchangeable collared crank-shafts have been made, each of which weighed about 32 tons.

The shafts of the Fall River steamer "Puritan" were made here, each of them weighing about 40 tons. The beam strap for the same vessel weighed 20 tons, and the connecting rods 21 tons. Other heavy forgings have been made for various Sound boats, and for several of the Brazilian line boats.

WALKER MANUFACTURING COMPANY.

The growth of this concern has been phenomenal, and they are now about completing new buildings, which will make the plant one of the largest and most complete engineering establishments in the Central States. Their work is mainly on cable road equipment, and as this work is heavy, the tools are large, some of them being special, and built on the premises.

A COMBINED LATHE AND PLANER.

The most notable of these is a machine which is a combination of lathe and planer—a combination which seems at first thought to be rather incongruous, but for the work which they do on it, the machine answers very well. There is a pit in the floor about 30 feet long and 8 feet wide, walled up. Running along each side of this pit are heavy beams which form slides. These are joined at the ends, so that the whole makes a rectangular frame 30 feet long and 8 feet wide, about level with the floor, and inside of which is the pit. Housings are placed on these beams, which support the journals of a shaft on which is mounted such a piece of work, for instance, as a sheave wheel for a cable railway plant. On the same shaft is fastened a large spur gear, which is part of the machine, and which is divided into two parts, so that it can be put on the shaft at any point, split bushings being provided to adapt it to any shaft, the hub being bored out for the largest ever required. This gear is then driven by a pinion which is at the end of a shaft that is driven by worm gearing, the worm being on a long shaft which passes along the entire length of the machine at one side. A cross-rail, something like that of a planer, is then placed across in front of the work, and you have the lathe.

For a planer the work is put down into the pit, there being cross-bars in it which can be adjusted to the proper height for supporting it to bring the working surface nearly level with the tops of the beams. Then a cross-rail is put on, which is made to travel from one end of the machine to the other, over the work, the driving power being applied at each end of the rail. This rail carries a head similar to that of the ordinary planer, which, traveling over the work, operates in the same way, except that the tool is moved instead of the work. Another machine is to be built similar to this one, which is to be 50 feet long, 12 feet 6 inches wide.

The new machine shop and foundries were, at the time of my visit, just being gotten into shape, and the transferring from the old to the new shops made things look rather chaotic, but it could easily be seen that it will be one of the model establishments, and thoroughly equipped with everything required for their work. The main machine shop will be supplied with overhead traveling cranes, and every other modern feature, and in it will be some unusually heavy tools, such as boring and turning mills up to 24 feet, with lathes and planers to correspond. Among the new lathes already on the ground ready to be put in place, is a Niles 72-inch swing, with 40-foot bed.

The foundry is intended to be one of the best. It will have six traveling cranes in three bays, the two cranes in the center being of 30 tons capacity each, the others smaller. There will be four cupolas, ranging from 30 inches to 84 inches. F. J. M.

Machinists' Supplies and Iron.

NEW YORK, April 25, 1891.

Iron—American Pig—There is nothing new in the general situation, and prices rule in buyers' favor, though there has been no quotable change.

We quote No. 1 Foundry, Standard Northern brands, $17 to $18; No. 2 is selling at $15.75 to $17; and Gray Forge at $14.25 to $15. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.25 to $16 for No. 2, and $14 to $14.50 for No. 3.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22; and Eglinton, $20.50.

Copper—The market is, generally speaking, quiet, and prices are steady. Lake copper is being sold at 13¾c. to 14c.; Arizona Ingot, 12⅞c. to 13c.; casting brands, 11½c. to 11¾c.

Lead—Buyers seem to generally expect lower prices, views which are not agreed to by holders, the result being that little business is being done. For spot 4.30c. to 4.35c. is asked, and 4.15c. offered.

Spelter—Smelters ask 4.85c., but stock in second hands can be had at 4.65c., f. o. b. Little business is being done.

Tin—The market is dull and prices unsettled, the general tendency being downward. Values for Straits of Malacca, spot, range from 19.30c. to 19.50c.

Lard Oil—The market shows some signs of unsteadiness and prices for prime range from 55c. to 55½c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Agents in every shop for fine tools; big inducements. Address E. G. Smith, Columbus, Pa.

Boy 17 (Philadelphia) desires to learn the machinist trade. Address J. H., AM. MACHINIST.

A well-recommended millwright and machinist wants position. Address Expert, Am. Machinist.

Wanted—A man that can influence trade in hyd. or refrigerating machinery. Apply to S. H., 245 N. J. R. R. Ave., Newark, N. J.

Wanted—Draftsman experienced in designing heavy machine tools, especially punching and shearing machinery. Address A. R. K., Am. Mach.

Mechanical engineer wants position as draftsman or superintendent; can give exceptional references. Address W. H. F., American Machinist.

Machinist desires position in machine shop, with prospects of taking share in same; experienced in engine and pump works. A., Am. Machinist.

Wanted—Foreman for gas and lamp fixture manufactory; give references and salary required. Address Safety Lamp Co., Louisville, Ky.

Wanted—Position as draftsman by young man 23; have had 3 years at technical school, 2 years' experience in machine shop, and experience as practical draftsman. W. L. S., Am. Machinist.

Wanted—Situation as blacksmith foreman; 49 years old; 30 years' exp.; 10 y'rs assistant foreman; well up in handling men; used to locomotive work; temperate and reliable. R. C., Am. Machinist.

A position wanted by a pattern maker and draftsman; an expert in the plumber material business; could equip a new plant; I have 200 drawings on hand of valves, etc. Box 85, Am. Machinist.

Wanted—Situation as supt., by man of large experience in light manufacturing business; best of reference as to ability and character. Address Box 86, Am. Machinist.

Wanted—Foreman to take charge of machine shop employing seventy hands; must be well up in general tool and fine work; also a good manager; wages, $21 per week. Address R. D. Nuttall & Co., 179 to 189 Grant ave., Allegheny, Pa.

Wanted—Foreman to take charge of a machine shop employing about fifty men; must be energetic, competent to manage men, and experienced in building high grade steam engines. Address M. Co., Am. Machinist.

Wanted—Vise hands; a few good tool makers to work on punches and dies, and screw machine tools. Address, stating age, experience, and wages wanted, Metric Metal Co., Beaver Falls, Pa. Works will soon be removed to Erie, Pa.

Wanted—Foreman for foundry, near N. Y. City, making machine castings; must be competent to turn out good work in dry or green sand and loam, and capable in other respects. Address Box 82, American Machinist.

Wanted—Position as supt. or foreman, by a young man, 36, successful in the systematic manufacture of machinery and mechanical devices, and in the economical management of men; a designer and draftsman of automatic and interchangeable machinery, tools, jigs, etc. W. H. S., Box 197, Burnside, Conn.

Wanted—Foundry foreman, strictly temperate, pushing and having experience in handling men; must be well up in heavy green and dry sand molding, and conversant with cupola and air furnace practice. Lewis Foundry & Machine Co. (Limited), Pittsburgh, Pa.

Wanted—Foundry foreman; one skilled in heavy work of all kinds, in loam, dry and green sand work; must be well up in this line, and strictly temperate; permanent position and good wages to right man. Address, giving experience and reference, Bole, 624, Columbus, Ohio.

Wanted—An energetic young man to take charge of drawing office in an engine and boiler works; must be a good designer, accurate draftsman, and well grounded in first principles; an all-around man, especially one having practical shop experience, preferred; familiarity with single-valve automatic engines a recommendation. Address M., 450 Fifth ave., City.

Wanted—Foreman for brass finishing department on valves, cocks and specialties; must have executive ability, and be familiar with modern tools. Address, stating salary req'd, Box 75, Am. Machinist.

Wanted—A thoroughly competent foreman for a machine shop in Ontario, Canada, in a live railway town, making mowers, reapers, binders, horse rakes and plows. From 60 to 80 hands in that department. None but experienced men, accustomed to agricultural implement work, need apply. Must be quick at figures, and understand all the latest methods of doing work cheaply and to advantage. State age, and salary expected. Apply to Box 78, American Machinist.

Foreman machinist, sober and steady, by a millwright and machine firm working from 4 to 10 machinists; only those capable of establishing good system in the shop (a place for everything, and everything in its place) need apply; must also be a quick workman himself, competent to take hold of any tool, and show a workman how to turn work out rapidly, and willing in dull times to make a hand himself; to such a man a permanent job and chance for advancement will be given. Address, stating age, experience, and wages expected, W. E. Caldwell & Co., 218 and 220 East Main street, Louisville, Ky.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O

All sizes punch presses. R. T. Lane, Cleveland, O.

Special wire mach'ry. Amer. Tool Wks., Clev'd, O

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Wanted—Mechanical drawing and designing by an engineer of experience. M. E., Am. Mach.

Screw cutting lathes any size for sale, less than half cost; observe this. Box 84, Am. Machinist.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

A well-established firm in Germany wants to represent, or take license to manufacture, a patented American article in the iron or metal line. Address propositions to W. Grevel, B'way and 10th st., N. Y.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa

For Sale—At a bargain, well-established machine shop in South Jersey doing a good business on new work and general repairs. Sold only on account of ill health. Address Box 77, American Machinist.

Wanted—One or more parties to purchase with the advertiser a desirable part of the manufacturing business of an old-established concern, who has not the room or facilities to continue it. An opportunity is here offered for a profitable investment, the purchasers to take an active part in the management or not, as may be arranged. Location, a flourishing city of 135,000 people in New York State. Address Enterprise, American Machinist.

"TIME IS MONEY."

"The smith his iron measures
Hammered to the anvil's chime."—Longfellow.

"And his **BRADLEY HAMMER** treasures,
Since it saves him work and time."—Some-other-fellow.

2000 IN USE. PLEASE INVESTIGATE.

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14 Warren St., New York. 96 & 98 Sudbury St., Boston.

CONSTRUCTIVE STEAM ENGINEERING,
ENGINES, PUMPS and BOILERS,
Their Accessories and Appendages.
By JAY M. WHITHAM, M. E., C. E.,
Author of STEAM ENGINE DESIGN.
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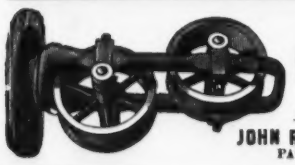
WELDLESS
SMOOTH COLD DRAWN
John S. Leng's Son & Co. New York.



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FOR
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JOHN ROYLE & SONS,
PATERSON, N. J.

FOR SALE.

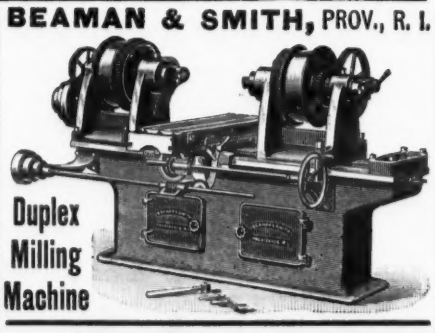
The following new boilers were in our shop at the time of our fire, and will be offered cheap to close out:

Two	12 H.P.	Vertical	Boilers.
One	10 "	Locomotive	"
Two	15 "	"	"
One	25 "	"	"
One	35 "	"	"
One	40 "	"	"
One	20 "	Return Tubular	"
Two	54 "	Two-flue	"

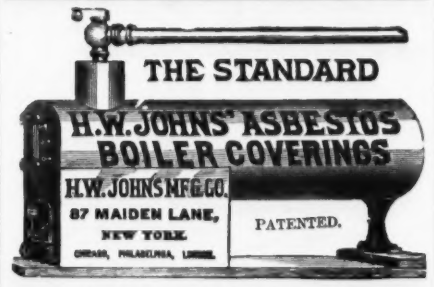
One Boiler for Consolidation Locomotive.

Richmond Locomotive & Machine Works,
RICHMOND, VA.

BEAMAN & SMITH, PROV., R. I.



Duplex Milling Machine



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We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

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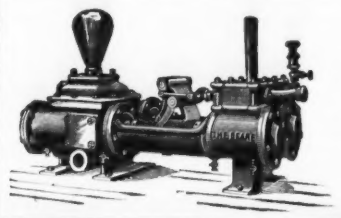

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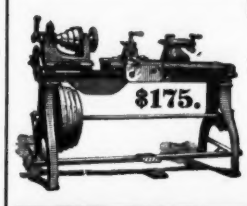

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Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.
CAN BE FORGED HOT.

Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.

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Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
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For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
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OUR NEW **CATALOGUE OF TOOLS**
And Supplies sent free to any address on receipt of Ten Cents in Stamps (for postage).
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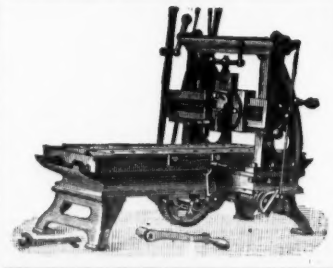

SMALL POWER OR HAND PLANER.
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Weight of Platen 100 lbs.
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42,000 IN USE.

PENBERTHY AUTOMATIC INJECTOR.

"Efficiency 99 1-2 per cent." (*Michigan University.*) "Efficacy 99.2 per cent." (*New Albany Laboratory.*)

RANGE 20 to 150 lbs. Lift 20 ft. Hot water supply, 115 to 128 deg. 80 lbs. pressure. One Valve to operate. Automatic and re-starting.

EASTERN DEPOT: DONEGAN & SWIFT, 11 Murray St., N. Y.
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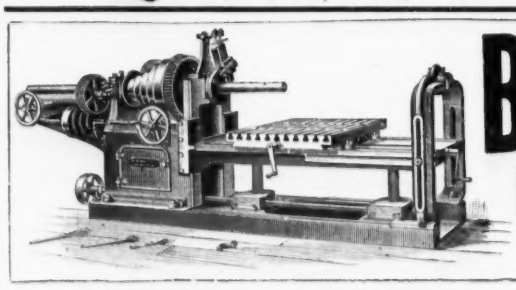
Trial, 30 Days. Return if not satisfactory.



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FOR EVERY VARIETY OF WORK.

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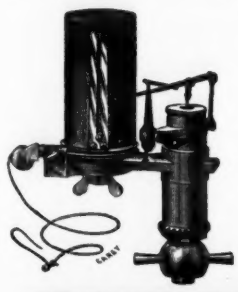
5,000 IN USE.



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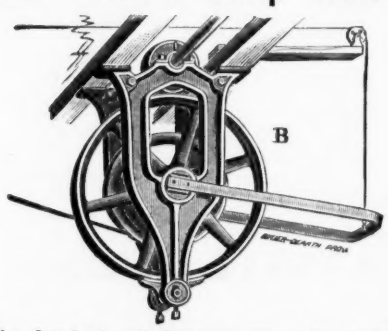

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THE GILKERSON MACHINE CO.
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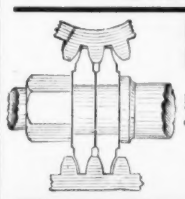

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One pair of these Cutters cuts a pitch of interchangeable gear wheels from 15 teeth to a rack inclusive.
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CASTINGS.
GENERAL MACHINE WORK.
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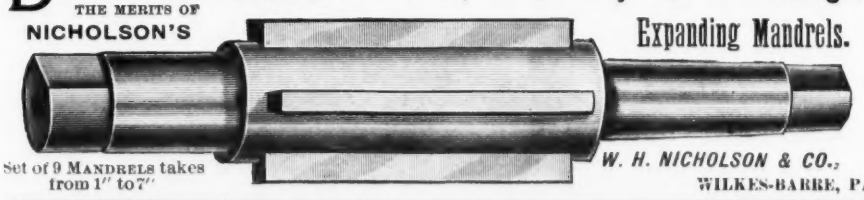

Set of 9 MANDRELS takes from 1" to 7"
W. H. NICHOLSON & CO.,
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The AMERICAN MACHINIST March 19, quoting from *Mechanical Progress*, says

"We don't hear so much of late of the 'perfection' of cast gears, and the benefits of the hard scale or surface left on the teeth. This sort of engineering twaddle did very well when appliances were wanting for cutting the teeth of gears cheaply. It was making a virtue of necessity."

We have especially good facilities for
GEAR CUTTING
and can furnish
CUT GEARS
(in quantities,) at prices that will compare favorably with those of Cast Gears. Correspondence solicited.

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DETROIT, MICH.

C. W. LE COUNT,
South Norwalk, Conn.

REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG

No.	Inch.	Prics.
1	3-8	$ .40
2	1-2	.50
3	5-8	.60
4	3 4	.60
5	7-8	.70
6	1	.70
7	1 1 8	.80
8	1 1-4	.80
9	1 3-8	.95
10	1 1-2	.95
11	1 3 4	1.10
12	2	1.20
13	2 1-4	1.36
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
19	5	3.25
Full set of 19		$23.60
20 (ext.)	5 1-2	4.00
21 (ext.)	6	5.00

This Dog has a Very Heavy Boss, so that if the thread wears a Heavier Screw can be substituted.

Le Count's Heavy Steel Dog.
With Steel Screw, Lathe Made and Hardened.
When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.

One Small Set of 8—by 1-4 inches to 20 inch, - - $ 6.28
One Set of 12—by 1-4 in. to 2 in. continued by 1-2 in. to 4 in 13.35

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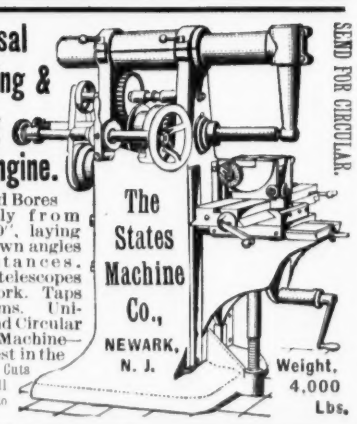

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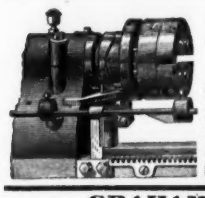

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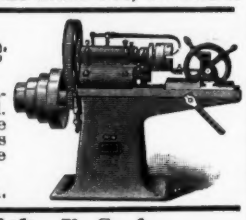

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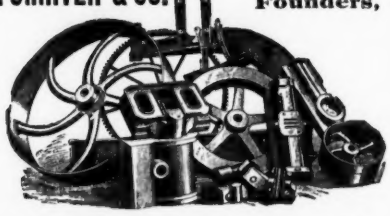

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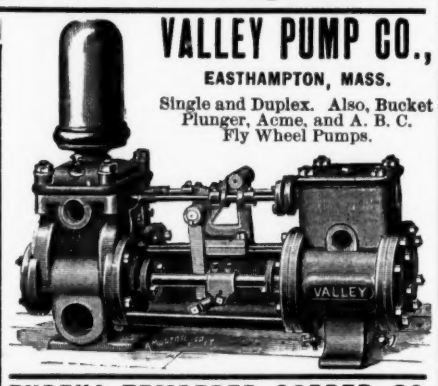

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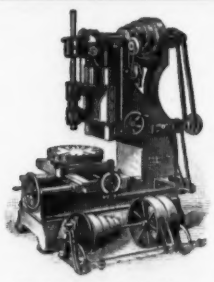

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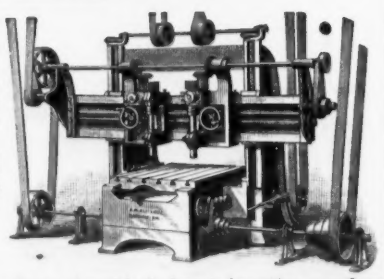

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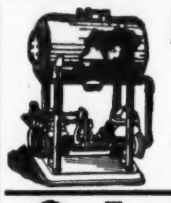

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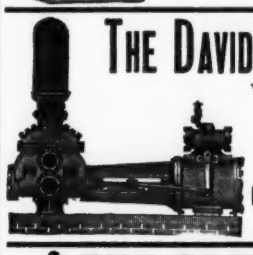

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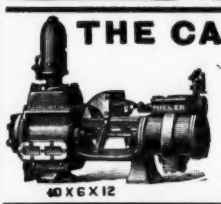

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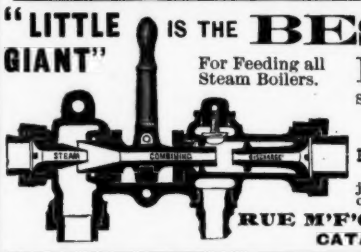

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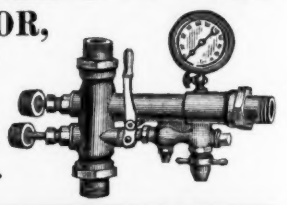

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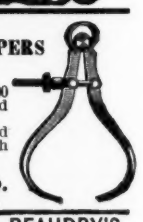

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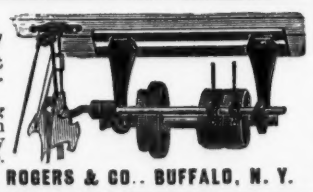

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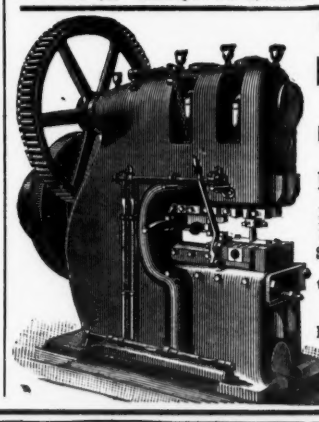

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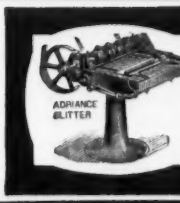

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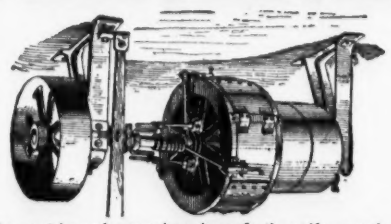

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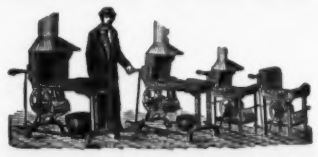

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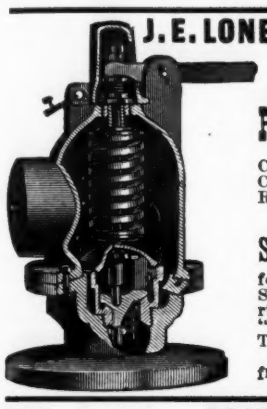

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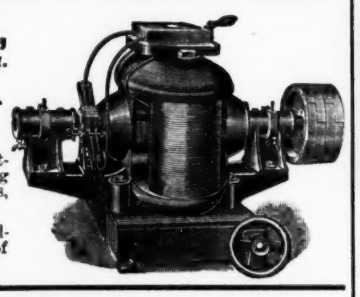

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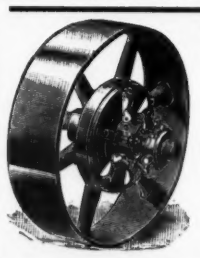

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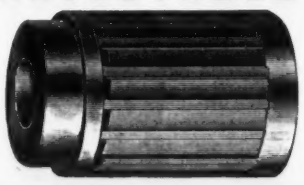

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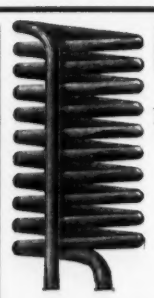

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LATHE and DRILL CHUCKS.

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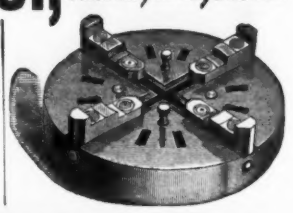
Geared Combination Chucks.

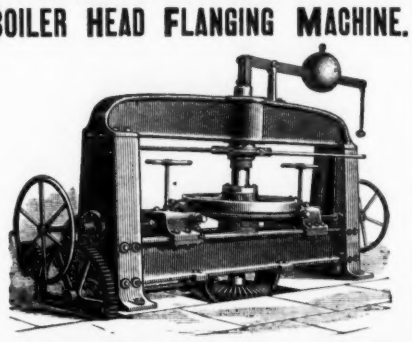
Both 3 and 4 Jaw.

Jaws Reversible.

Diameter.	Capacity.
5 inch.	5 inch.
7¼ "	7¼ "
10⅜ "	10⅜ "
13 "	13⅛ "
15¼ "	17 "
18 "	19¾ "
21 "	25½ "
24 "	28 "



O'BRIEN'S PATENT BOILER HEAD FLANGING MACHINE.



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TWO JAW CHUCKS

BOX BODY 7-9 12 & 15 INCH ROUND BODY 4-6-7-& 9 INCH WITH VARIOUS STYLES OF JAWS

For Brass Workers and for General Machinists Use

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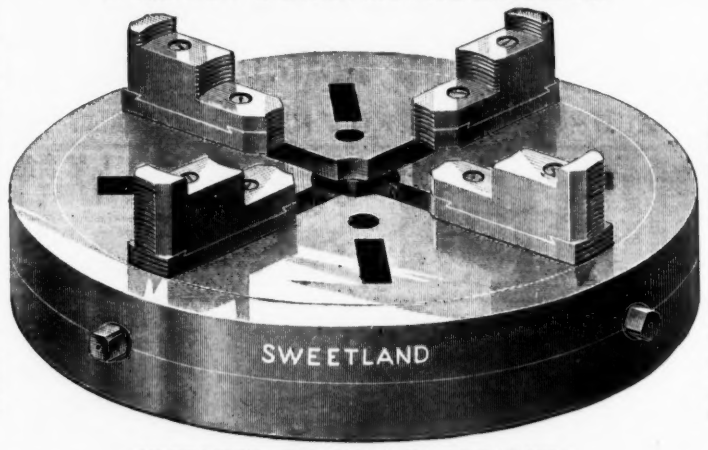

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CHAMPION SCROLL CHUCKS.

In 5 sizes, for foot Lathes and all classes of light work. Adopted as standard and kept in stock by the largest firms making such machinery. For sale at all supply stores. Ask for our Champion Chuck.

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ALUMINUM PER $1.50 POUND

THE

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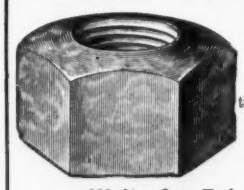
Owing to the decision of Judge Ricks in the Circuit Court of the United States for the Northern District of Ohio, in the case of The Pittsburgh Reduction Co. against the Cowles Electric Smelting and Aluminum Co., No. 4869 in Equity, the price of aluminum is fixed at $1.50 per lb., and the Cowles Company is enjoined and restrained from increasing its manufacture of pure aluminum over the rate at the time the suit was entered, in February, 1891, and also from selling or offering for sale pure aluminum, or the products of its process for reducing aluminum, at lower prices than the price of $1.50 per pound, which rate is fixed by The Pittsburgh Reduction Co. All persons are hereby notified and warned that if they purchase from the Cowles Electric Smelting and Aluminum Co., at a less rate than $1.50 per lb., in any quantities, they will be liable therefor.

No difference in quality of metal will be any excuse or reason for sales by the Cowles Company at a less rate than $1.50 per lb.

Finished Hexagon Nuts.



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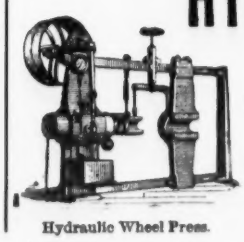

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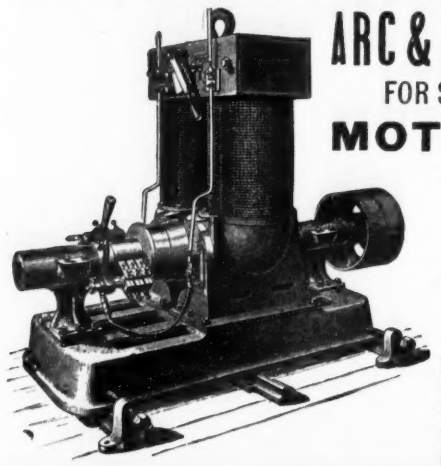

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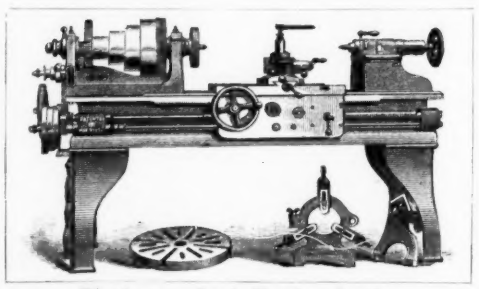

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BUILD and REPAIR YOUR MACHINERY BY USING
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Work and traverse instantly varied to any speed between extremes. Reversing points varied by hand. Pivoted table simultaneously clamped at both ends by hand, has no slot or screws on its end; easy to keep clean; is graduated in ¼ degrees and in taper in inches per foot.

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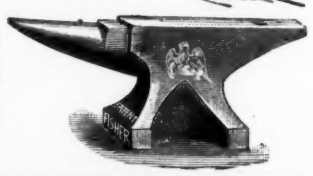

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Portable Key-Way Cutters and Portable Planers a specialty, ranging in size and capacity from the smallest cutting work to key-ways 5 ft. long and 6 ins. wide. Over 150 machines in use in the leading shops of this and other countries. For further information address

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Special facilities for Accurate Work.

Bevel Gears cut theoretically Correct.

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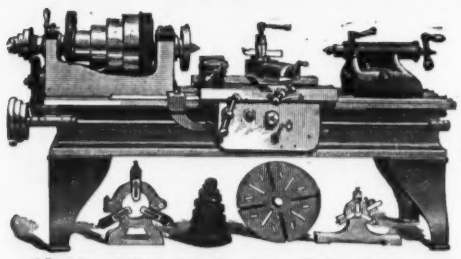

17, 19 and 21-inch Swing, Large Hollow Spindle.
Taper Attachment, Automatic Stop, Compound Rest, Lead Screw, under front V. All feeds reversed in apron.
Extra heavy, Convenient, and easily handled.

EASTERN HOUSE:
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24, 27, 32 and 38-inch Swing, Cabinet Legs.

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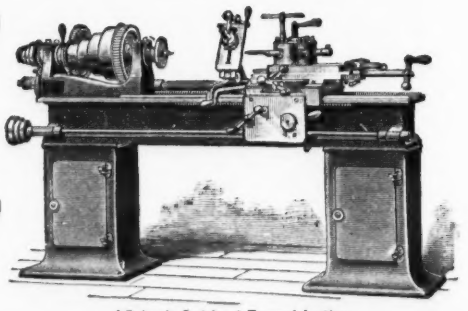
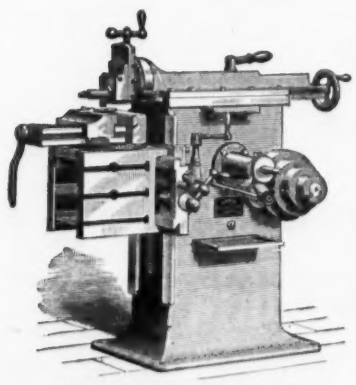
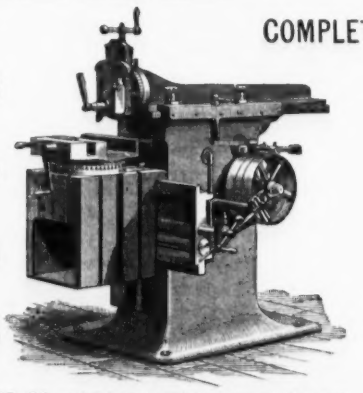


18-inch Cabinet Turret Lathe.
Taper Attachment, Automatic Feed, Lever and Screw Movement, most complete brass lathe on the market.

COMPLETE MACHINE SHOP EQUIPMENTS A SPECIALTY.



ENGINE LATHES
TURRET LATHES
IRON PLANERS
PULLEY LATHES



15 and 20-inch Crank Shaper.
Stroke changed and adjusted while running. Stroke at all times positive. Invariably plane to a line. Detachable Tables.

20, 26 and 32-inch Triple Geared Shapers.
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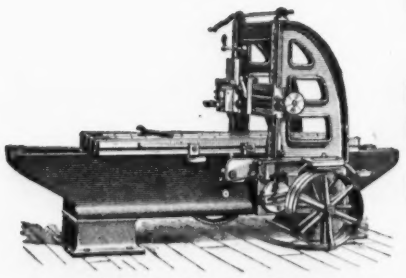

24, 32 and 36-inch Planers.
Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides.
Improved device for holding Planer Bolts.

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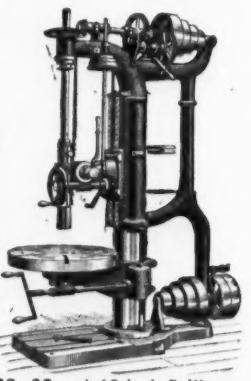
MILLING MACHINES
IRON SHAPERS



25, 28, 32 and 40-inch Drills.
Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

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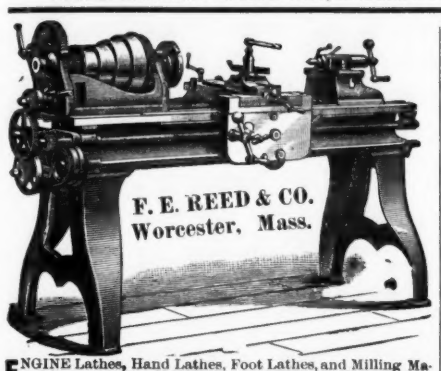
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.



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ANY LENGTH OF BED DESIRED.
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IMPROVED PATENT IRON PLANERS A SPECIALTY.
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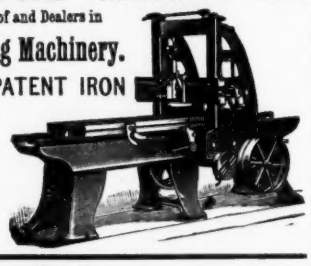

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Near Culvert,
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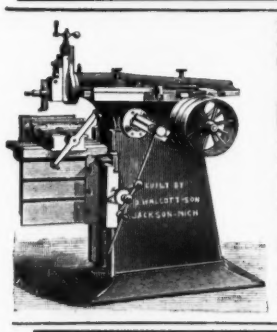

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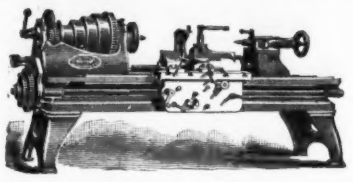

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NEW HAVEN, CONN.
IRON-WORKING MACHINERY,
Planers, Shapers, Drills, Slotters, Etc.

Something New!!
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TURN TABLE TURRET LATHE
Now Ready.
JONES & LAMSON MACHINE CO.
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Lathes from 10 in. to 20in. swing. Largest Variety of Drills manufactured in the world.
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GENTLEMEN:
We have used one of your back-geared Universal Milling Machines for several months. The foreman in charge of the department in which it is located reports the machine satisfactory and one that can be recommended to intending buyers as well built and convenient.
Very truly yours,
THE PRATT & WHITNEY CO.
R. F. Blodgett, *Sec'y.*

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MANUFACTURERS OF
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D. SAUNDERS' SONS,

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Steam & Gas Fitters' Hand Tools.
Pipe Cutting, THREADING, AND Tapping Machines.

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THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

IMMEDIATE DELIVERY.
15" and 18" Crank } SHAPERS.
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Manufacturers of
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Bolt Cutting Machines.
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MANUFACTURER OF
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UPRIGHT DRILLS,
In the following sizes: 20", 22", 25", 26", 28", 30", 32", 34" & 36".
Send for cuts and prices before you buy.
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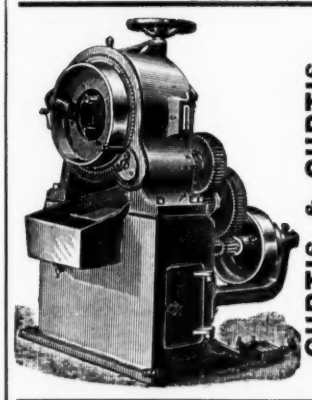

CURTIS & CURTIS,
66 CARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting & Threading Machinery,
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

BARNES'
New Friction Disk Drill.
FOR LIGHT WORK.
Has these Great Advantages:
The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. Send for catalogue.
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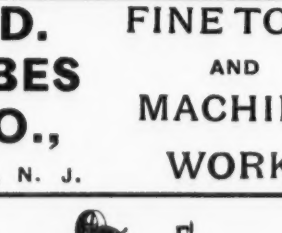
BARNES' Pat. FOOT POWER MACHINERY



I feel so highly pleased with your Velocipede Foot Power with seat, that I wish to add my testimony to its superiority. I did not expect to like it, but having used the Velocipede Power I would have nothing else. It so greatly lessens the fatigue of using foot power, in fact, it may be said to be almost without fatigue, and is a steadier motion. I only wish I had known of it sooner. SEND FOR CATALOGUE. W. F. & J. BARNES CO. 1995 Ruby St., Rockford, Ill.

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Bench Style.

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SHARP TOOLS—GOOD WORK.

THIS Universal Cutter AND Reamer Grinder will grind all kinds of cutters and reamers up to 8" diam. without the use of special attachments.
SIMPLE, ACCURATE, RAPID.
Price, $150.
Write for Catalogue.
ADDRESS THE CINCINNATI MILLING MACHINE CO., Cincinnati, O.

PATENT FRICTION SHAPER.

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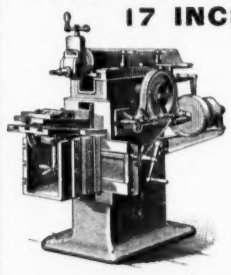
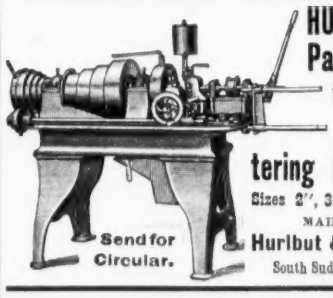


Double racks allowing shaft 2½ to pass through base. Adjustable table for taper work, swivel jaw vise, feed adjustable while running, driven by hardened steel worm in phosphor bronze wheel; smooth running, powerful, durable.
J. D. Wright & Sons,
69 & 71 GEORGE ST., BROOKLYN, E. D., N. Y.



HURLBUT'S Patent Cutting-off and Centering Machine.
Sizes 2", 3", 4", 5", 6".
MADE BY Hurlbut & Rogers,
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Send for Circular.

3/8" FLEXIBLE METALLIC FILLET
FOR PATTERN MAKERS. 8 Sizes.
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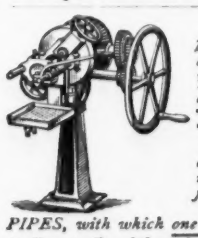

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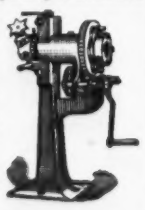

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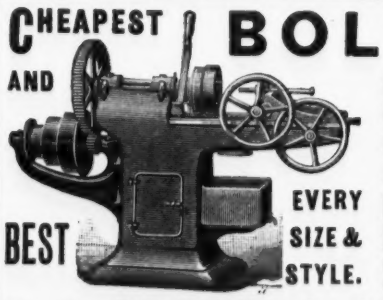

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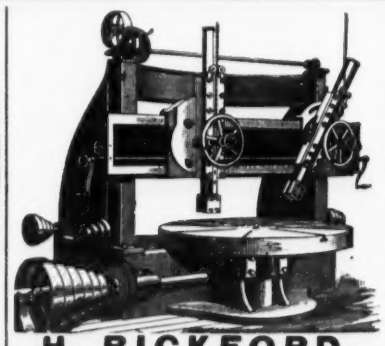

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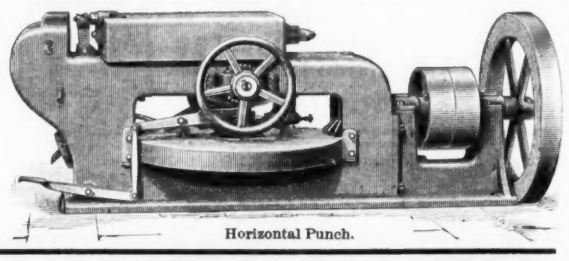
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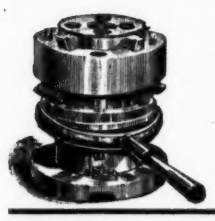

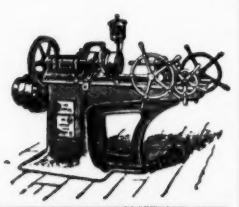

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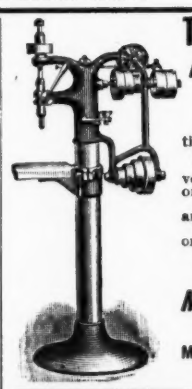

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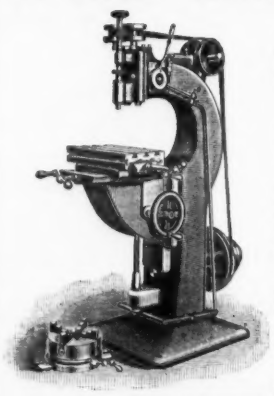

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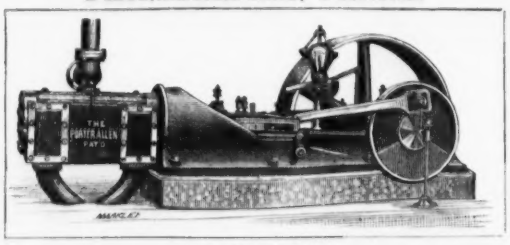

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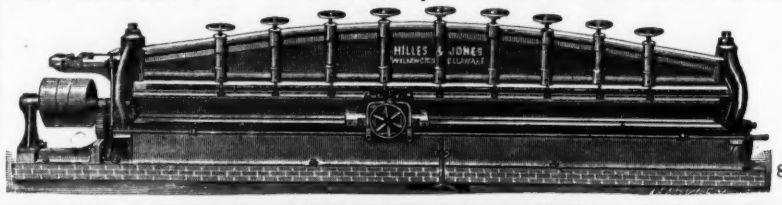

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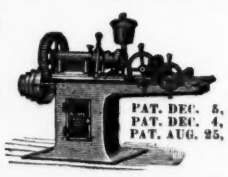
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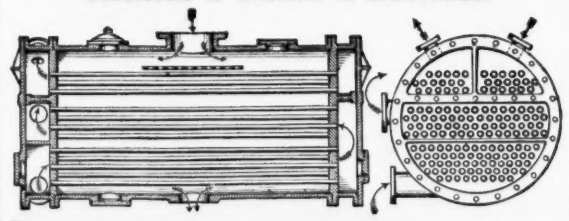

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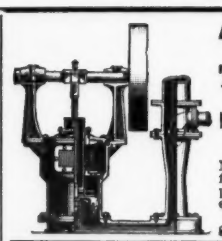

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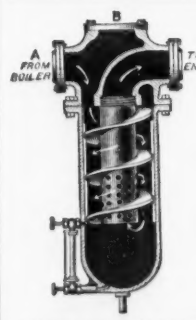

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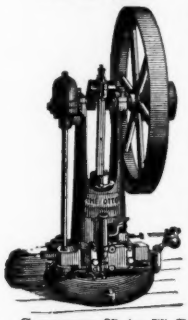

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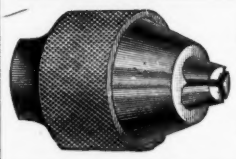

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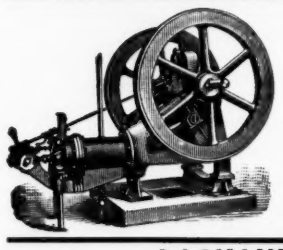

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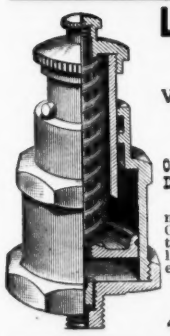

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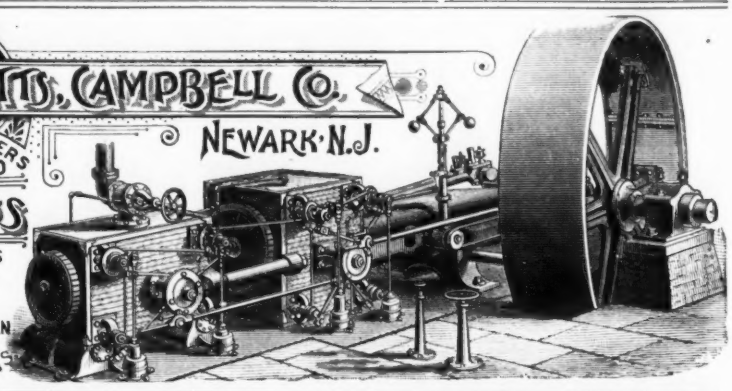

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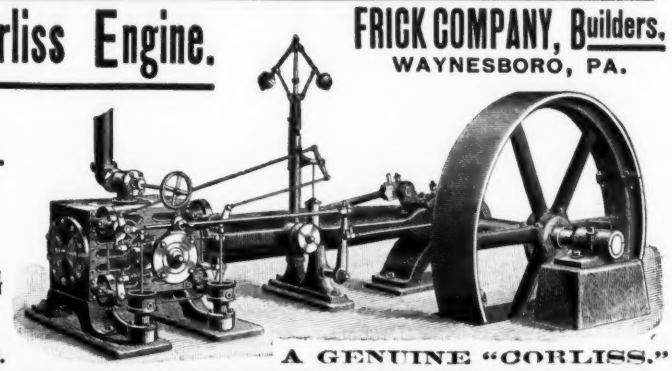

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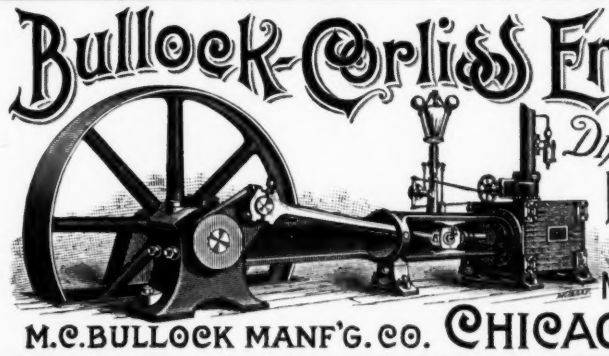

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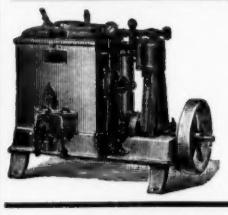

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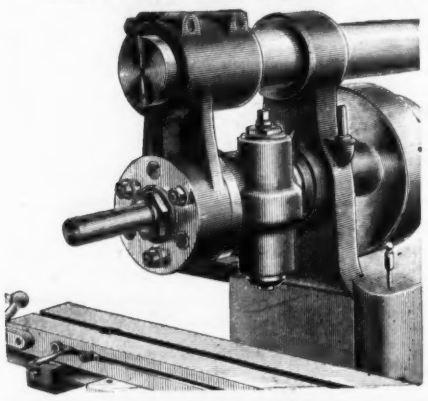

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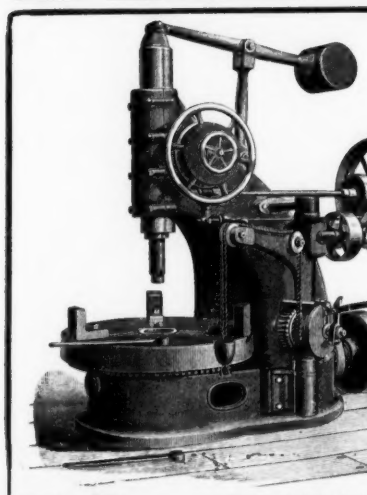

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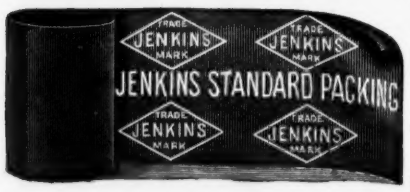

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N. B.—See "Advertisement," page 16.

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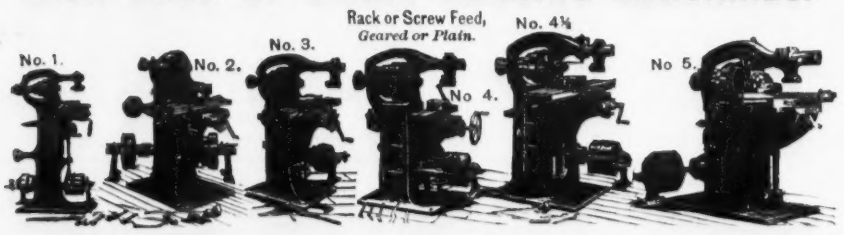

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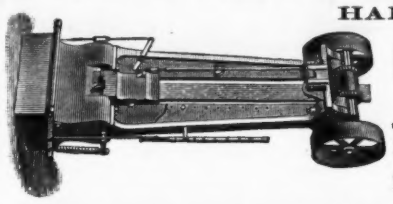

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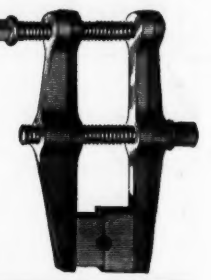

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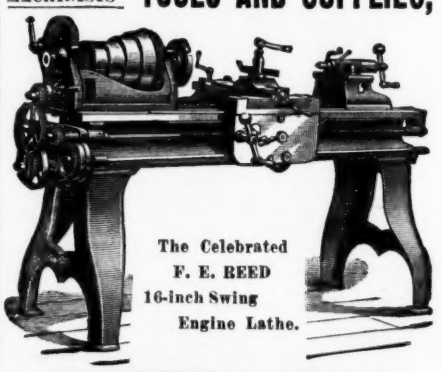

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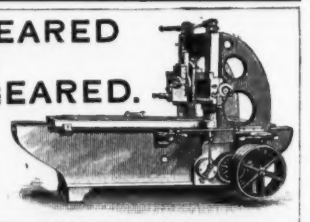

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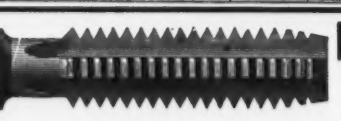

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